

UNITED STATES DEPARTMENT OF VETERANS AFFAIRS



SOLICIATION PACKAGE INCLUDING PROJECT MANUAL (100% DESIGN LEVEL)
FOR

**SANTA FE
NATIONAL CEMETERY
REPAIR COLUMBARIUM 2 WALL**

Project Number: 904CM3927

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Prepared by:
JACOBS™
180 Promenade, Suite 300
Sacramento, California 95834
(916) 929.3323

SPEC SET NO.

Subconsultants

Cost Estimating
Sierra West Group LLC
2730 Gateway Oaks Drive #1100
Sacramento, CA 95833
(916) 925-4000

Structural Engineer
Buehler & Buehler Structural
600 Q Street
Sacramento, CA 95811
(916) 443-0303

Geotechnical Engineer
Stevens Ferrone & Bailey
1600 Willow Pass Court,
Concord, CA 94520
(925) 688-1001

Santa Fe National Cemetery Repair Columbarium 2 Wall
VA Project Number: 904CM3927

SECTION 00 01 10

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LIST OF DRAWINGS

The drawings listed below accompanying this specification form a part of the Contract.

SHT.#	SHEET REF.	SHEET NAME
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2	B-1	TOPOGRAPHIC SURVEY SITE MAP
3	B-2	SUBSURFACE INVESTIGATION BORING LOCATION PLAN & BORING LOGS
4	B-3	SUBSURFACE INVESTIGATION BORING LOGS
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12	L-500	CONSTRUCTION DETAILS
13	S-100	STRUCTURAL DRAWINGS

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SECTION 01 00 00

GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL INTENTION

- A. Contractor shall completely prepare site for building operations, including demolition and removal of existing structures, and furnish labor and materials and perform work for niche cover and façade removal and storage; niche cap removal and storage; sidewalk removal and reconstruction; pressure grouting compaction; columbarium removal and storage; columbarium foundation repair; retaining wall repair; replacement of columbarium, niche unit covers, cap, and facades, and miscellaneous improvements as required by drawings and specifications.
- B. Visits to the site by Bidders may be made only by appointment with the Cemetery Director.
- C. Offices of Jacobs Engineering Group Inc, as Architect Engineers, will render certain technical services during construction. Such services shall be considered as advisory to the Government and shall not be construed as expressing or implying a contractual act of the Government without affirmations by Contracting Officer's Technical Representative (COTR) or his duly authorized representative.
- D. All employees of General Contractor and subcontractors shall comply with VA security management program and obtain permission of the VA police, be identified by project and employer, and restricted from unauthorized access.
- E. Prior to commencing work, General Contractor shall provide proof that a OSHA certified "competent person" (CP) (29 CFR 1926.20(b)(2)) will maintain a presence at the work site whenever the general or subcontractors are present.
- F. Training:
 - 1. All employees of general contractor or subcontractors shall have the 10-hour OSHA certified Construction Safety course and /or other relevant competency training, as determined by VA COTR.
 - 2. Submit training records of all such employees for approval before the start of work.

1.2 STATEMENT OF BID ITEM(S)

- A. CONTRACT LINE ITEM NUMBER (CLIN) I, GENERAL CONSTRUCTION: Work includes general construction, alterations, niche cover and façade removal (including marble trim piece with row indicator letters and metal column numbers), and storage; niche and pier cap removal and storage; sidewalk removal and reconstruction; pressure grouting compaction; columbarium removal and storage; columbarium foundation repair; retaining wall repair; replacement of columbarium, niche unit covers, cap, and facades; placement of one new precast

columbarium unit to match the existing; and miscellaneous improvements and necessary removal of existing structures and construction and certain of other items.

- B. CONTRACT LINE ITEM NUMBER (CLIN) II, REPLACE COLUMBARIUM WALL CAP: Contract Work intends to remove, salvage, and re-install the existing columbarium wall cap. Contractor to provide a separate line item cost for removal and disposal of the existing cap and placement of a new cap in the event that the existing cap is not suitable for replacement.
- C. CONTRACT LINE ITEM NUMBER (CLIN) III, REPLACE COLUMBARIUM UNITS: Contract Work intends to remove, salvage, and re-install the existing columbarium units, with the exception of one damaged unit needing replacement. Contractor to provide a separate line item cost for removal and disposal of the remaining columbarium units and placement of new precast columbarium units in the event that the existing units are not suitable for replacement.
- D. CONTRACT LINE ITEM NUMBER (CLIN) IV, REPLACE END PILASTER: Contract Work intends to protect-in-place the existing end pilaster. Contractor to provide a separate line item cost for removal and replacement of the existing end pilaster, stone veneer and cap in the event that is damaged by niche wall repair.

1.3 SPECIFICATIONS AND DRAWINGS FOR CONTRACTOR

- A. AFTER AWARD OF CONTRACT, one (1) set of specifications and drawings will be furnished.
- B. Additional sets of drawings may be made by the Contractor, at Contractor's expense, from Bond.

1.4 CONSTRUCTION SECURITY REQUIREMENTS

- A. Security Plan:
 - 1. The security plan defines both physical and administrative security procedures that will remain effective for the entire duration of the project.
 - 2. The General Contractor is responsible for assuring that all sub-contractors working on the project and their employees also comply with these regulations.
- B. Security Procedures:
 - 1. For working outside the "regular hours" as defined in the contract, the General Contractor shall give 3 days notice to the COTR. This notice is separate from any notices required for utility shutdown described later in this section.
 - 2. No photography of VA premises is allowed without written permission of the COTR except as required described later in this section.
 - 3. VA reserves the right to close down or shut down the project site and order General Contractor's employees off the premises in the event of a national emergency. The General Contractor may return to the site only with the written approval of the COTR.

1.5 FIRE SAFETY

- A. Applicable Publications: Publications listed below form part of this Article to the extent referenced. Publications are referenced in text by basic designations only.
 - 1. American Society for Testing and Materials (ASTM):
 - E84-2009a Surface Burning Characteristics of Building Materials
 - 2. National Fire Protection Association (NFPA):
 - 10-2010 Standard for Portable Fire Extinguishers
 - 30-2008 Flammable and Combustible Liquids Code
 - 51B-2009 Standard for Fire Prevention During Welding, Cutting and Other Hot Work
 - 70-2008 National Electrical Code
 - 241-2009 Standard for Safeguarding Construction, Alteration, and Demolition Operations
 - 3. Occupational Safety and Health Administration (OSHA):
 - 29 CFR 1926 Safety and Health Regulations for Construction
- B. Fire Safety Plan: Establish and maintain a fire protection program in accordance with 29 CFR 1926. Prior to start of work, prepare a plan detailing project-specific fire safety measures, including periodic status reports, and submit to COTR/Cemetery Director for review for compliance with Contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. Prior to any worker for the Contractor or Subcontractor's beginning work, they shall undergo a safety briefing provided by the General Contractor's competent person per OSHA requirements. This briefing shall include information on the construction limits, safety guidelines, means of egress, break areas, work hours, locations of restrooms, use of NCA equipment, etc. Documentation shall be provided to the COTR that individuals have undergone the Contractor's safety briefing.
- C. Site and Building Access: Maintain free and unobstructed access to emergency services and for fire, police and other emergency response forces in accordance with NFPA 241.
- D. Separate temporary facilities, such as trailers, storage sheds, and dumpsters, from existing buildings and new construction by distances in accordance with NFPA 241. For small facilities with less than 6 m (20 feet) exposing overall length, separate by 3m (10 feet).
- E. Means of Egress: Do not block exiting for occupied buildings or site areas, including paths from exits to roads. Minimize disruptions and coordinate with COTR/Cemetery Director.
- F. Egress Routes for Construction Workers: Maintain free and unobstructed egress. Inspect daily.
- G. Fire Extinguishers: Provide and maintain extinguishers in construction areas and temporary storage areas in accordance with 29 CFR 1926, NFPA 241 and NFPA 10.

- H. Flammable and Combustible Liquids: Store, dispense and use liquids in accordance with 29 CFR 1926, NFPA 241 and NFPA 30.
- I. Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with COTR. Designate Contractor's responsible project-site fire prevention program manager to permit hot work.
- J. Fire Hazard Prevention and Safety Inspections: Inspect entire construction areas weekly.
- K. Smoking: Smoking is prohibited on Cemetery grounds.
- L. Dispose of waste and debris in accordance with NFPA 241. Remove from work area daily. Stockpile in an area agreeable to the Cemetery Director until removal from the site.
- M. Perform other construction, alteration and demolition operations in accordance with 29 CFR 1926.

1.6 OPERATIONS AND STORAGE AREAS

- A. The Contractor shall confine all operations (including storage of materials) on Government premises to areas authorized or approved by the COTR. The Contractor shall hold and save the Government, its officers and agents, free and harmless from liability of any nature occasioned by the Contractor's performance.
- B. Temporary buildings (e.g., storage trailers, office trailers) and utilities may be erected by the Contractor only with the approval of the COTR and shall be built with labor and materials furnished by the Contractor without expense to the Government. The temporary buildings and utilities shall remain the property of the Contractor and shall be removed by the Contractor at its expense upon completion of the work.
 - 1. Whenever it is required that a connection fee be paid to a public utility provider for new temporary or permanent service to the construction project, for such items as water, sewer, electricity, gas or steam, payment of such fee shall be the responsibility of the Contractor.
- C. The Contractor shall, under regulations prescribed by the COTR, use only established roadways, or use temporary roadways constructed by the Contractor when and as authorized by the COTR. When materials are transported in prosecuting the work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by any Federal, State, or local law or regulation. When it is necessary to cross curbs or sidewalks, the Contractor shall protect them from damage. The Contractor shall repair or pay for the repair of any damaged curbs, sidewalks, or roads. (FAR 52.236 10)
- D. Working space and space available for storing materials shall be as shown on the drawings or as determined by the COTR.
- E. Workmen are subject to rules of the Cemetery applicable to their conduct.

- F. Execute work so as to interfere as little as possible with normal functioning of Cemetery as a whole, including operations of utility services, fire protection systems and any existing equipment, and with work being done by others.
1. Do not store materials and equipment in other than assigned areas.
 2. Schedule delivery of materials and equipment to immediate construction working areas within buildings in use by the Department of Veterans Affairs in quantities sufficient for not more than two work days. Provide unobstructed access to the Cemetery grounds and areas required to remain in operation.
- G. Phasing: To insure such executions, the Contractor shall furnish the COTR with a schedule of approximate dates on which the Contractor intends to accomplish work in each specific area of site or portion thereof. In addition, the Contractor shall notify the COTR two weeks in advance of the proposed date of starting work in each specific area of site or portion thereof. Arrange such dates to insure accomplishment of this work in successive phases mutually agreeable to the Cemetery Director, COTR and Contractor.
- H. Cemetery will be operational during performance of work.
1. The Contractor shall take all measures and provide all material necessary for protecting existing property in affected areas of construction against dust and debris, so that affected areas to be used in the Cemetery's operations will not be hindered. The Contractor shall permit access to Department of Veterans Affairs personnel through other construction areas which serve as routes of access to such affected areas and equipment. Coordinate alteration work in areas occupied by Department of Veterans Affairs so that Cemetery operations will continue during the construction period.
- I. Construction Fence: Before construction operations begin, the Contractor shall provide a chain link construction fence, 2.1m (seven feet) minimum height, around the limit of work indicated on the drawings. Provide gates as required for access with necessary hardware, including hasps and padlocks. Fasten fence fabric to terminal posts with tension bands and to line posts and top and bottom rails with tie wires spaced at maximum 375mm (15 inches). Bottom of fences shall extend to 25mm (one inch) above grade. Remove the fence when directed by COTR
1. Construction fence will include screening to obstruct view of construction operations from Cemetery Visitors.
 2. Contractor to allow visitor access to occupied niches at all times except when construction operations is in the immediate area of the occupied niches during pressure grouting, construction of walk, or other construction activities where there is a threat to visitor safety.
- J. Utilities Services: Maintain existing utility services for the Cemetery at all times. Provide temporary facilities, labor, materials, equipment, connections, and utilities to assure uninterrupted services. Where necessary to cut existing water, sewer or air pipes, or conduits, wires, cables, etc. of utility services or of fire protection systems and communications systems (including telephone), they shall be cut and capped at suitable places where shown; or, in absence of such indication, where directed by COTR.

1. No utility service such as water, gas, steam, sewers or electricity, or fire protection systems and communications systems may be interrupted without prior approval of COTR.
 2. The Contractor shall submit a request to interrupt any such services to COTR and Cemetery Director, in writing, 48 hours in advance of proposed interruption. Request shall state reason, date, exact time of, and approximate duration of such interruption.
 3. The Contractor will be advised (in writing) of approval of request, or of which other date and/or time such interruption will cause least inconvenience to operations of the Cemetery. Interruption time approved by the Cemetery may occur at other than Contractor's normal working hours.
 4. In case of a contract construction emergency, service will be interrupted on approval of COTR. Such approval will be confirmed in writing as soon as practical.
 5. Whenever it is required that a connection fee be paid to a public utility provider for new permanent or temporary service to the construction project, for such items as water, sewer, electricity, gas or steam, payment of such fee shall be the responsibility of the Contractor.
- K. To minimize interference of construction activities with flow of Cemetery traffic, comply with the following:
1. Keep roads, walks and entrances to grounds, to parking and to occupied buildings clear of construction materials, debris and standing construction equipment and vehicles.
 2. Method and scheduling of required cutting, altering and removal of existing walks must be approved by the COTR.
- L. Coordinate the work for this contract with other construction operations as directed by COTR. This includes the scheduling of traffic and the use of roadways, as specified in Article, USE OF ROADWAYS.
- M. Coordination of Construction with Cemetery Director: The burial activities at a National Cemetery shall take precedence over construction activities. The Contractor must cooperate and coordinate with the Cemetery Director, through the COTR, in arranging construction schedule to cause the least possible interference with Cemetery activities in actual burial areas. Construction noise during the interment services shall not disturb the service. Trucks and workmen shall not pass through the service area during this period:
1. The Contractor is required to discontinue his work sufficiently in advance of Easter Sunday, Mother's Day, Father's Day, Memorial Day, Veteran's Day and/or Federal holidays, to permit him to clean up all areas of operation adjacent to existing burial plots before these dates.
 2. Cleaning up shall include the removal of all equipment, tools, materials and debris and leaving the areas in a clean, neat, accessible condition.

1.7 ALTERATIONS

- A. Survey: Before any work is started, the Contractor shall make a thorough survey with the COTR of all areas in which alterations occur and areas which are anticipated routes of access, and furnish a report, including sufficient

photography and/or video to document the existing conditions, signed by the Contractor and the COTR, to the Contracting Officer. This report shall list by areas and spaces:

1. Existing condition and types of finished surfaces not required to be altered throughout.
 2. Existence and conditions of items such as utilities and accessories, niche covers, columbaria, caps, veneers, etc., required by drawings to be either reused or relocated, or both.
 3. Shall note any discrepancies between drawings and existing conditions at site.
 4. Shall designate areas for working space, materials storage and routes of access to areas where alterations occur and which have been agreed upon by Contractor and COTR.
- B. Survey: Before any work is started, the Contractor shall survey, photo- or video-document, and manually record the existing columbarium numbering and lettering to ensure replacement to the same locations.
- C. Any items required by drawings to be either reused or relocated or both, found during this survey to be nonexistent, or in opinion of COTR, to be in such condition that their use is impossible or impractical, shall be furnished and/or replaced by the Contractor with new items in accordance with specifications which will be furnished by the Government. Provided the Contract Work is changed by reason of this subparagraph B, the contract will be modified accordingly, under provisions of clause entitled "DIFFERING SITE CONDITIONS" (FAR 52.236 2) and "CHANGES" (FAR 52.243 4 and VAAR 852.236 88).
- D. Re Survey: Thirty days before expected partial or final inspection date, the Contractor and COTR together shall make a thorough re-survey of the areas involved. They shall furnish a report, including sufficient photography and/or video to document the existing conditions, on conditions then existing finished surfaces as compared with conditions of same as noted in first condition survey report:
1. Re survey report shall also list any damage caused by the Contractor to such surfaces, despite protection measures; and, will form the basis for determining extent of repair work required of the Contractor to restore damage caused by the Contractor's workmen in executing Work of this contract.
- E. Protection: Provide the following protective measures:
1. Wherever existing columbarium surfaces are disturbed they shall be protected against water infiltration. In case of leaks, they shall be repaired immediately upon discovery.
 2. Temporary protection against damage for portions of existing structures and grounds where work is to be done, materials handled and equipment moved and/or relocated.

1.8 ENVIRONMENTAL CONTROLS

- A. In general, the following preventive measures shall be adopted during construction to keep down dust and prevent mold.
 - 1. Dampen debris to keep down dust and provide temporary construction partitions in existing structures where directed by COTR. Block off ducts and diffusers to prevent circulation of dust into occupied areas during construction.
- B. Vacuum and wet mop all transition areas from construction to the occupied Cemetery buildings at the end of each workday.
- C. Final Cleanup:
 - 1. Upon completion of the project, or as work progresses, remove all construction debris from all areas that have been part of the Work.
 - 2. All Work areas shall be cleaned prior to final inspection.

1.9 DISPOSAL AND RETENTION

- A. Materials and equipment accruing from work removed and from demolition of existing improvements shall be disposed of as follows:
 - 1. Reserved items which are to remain property of the Government are noted on drawings or in specifications as items to be stored, salvaged, or re-used. Items that remain property of the Government shall be removed or dislodged from present locations in such a manner as to prevent damage which would be detrimental to re installation and reuse. Store such items where directed by and in a manner approved by COTR so as not to cause damage to the items.
 - 2. Items not reserved shall become property of the Contractor and be removed by Contractor from the Cemetery.
 - 3. Items of portable equipment and furnishings located in areas in which Work is to be done under this Contract shall remain the property of the Government.

1.10 PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS

- A. The Contractor shall preserve and protect all structures, equipment, and vegetation (such as trees, shrubs, and grass) on or adjacent to the Work site which are not to be removed and which do not unreasonably interfere with the Work required under this Contract. The Contractor shall only remove trees when specifically authorized to do so, and shall avoid damaging vegetation that will remain in place. If any limbs or branches of trees are broken during Contract performance, or by the careless operation of equipment, or by workmen, the Contractor shall trim those limbs or branches with a clean cut and paint the cut with a tree pruning compound as directed by the COTR.
- B. The Contractor shall protect from damage all existing improvements and utilities at or near the Work site and on adjacent property of a third party, the locations of which are made known to or should be known by the Contractor. The Contractor shall repair any damage to those facilities, including those that are the property of a third party, resulting from failure to comply with the requirements of this contract or failure to exercise reasonable care in performing the Work. If the

Contractor fails or refuses to repair the damage promptly, the COTR may have the necessary work performed and charge the cost to the Contractor. (FAR 52.236 9)

- C. Refer to Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS, for additional requirements on protecting vegetation, soils and the environment. Refer to Articles, "Alterations", "Restoration", and "Operations and Storage Areas" for additional instructions concerning repair of damage to structures and site improvements.

1.11 RESTORATION

- A. Remove, cut, alter, replace, patch and repair existing improvements as necessary to install new Work. Except as otherwise shown or specified, do not cut, alter or remove any structural Work, and do not disturb any water, irrigation, drain, gas, or electric Work without approval of the COTR. Existing Work to be altered or extended and that is found to be defective in any way, shall be reported to the COTR before it is disturbed, including documentation by photography and/or video. Materials and workmanship used in restoring Work shall conform in type and quality to that of original existing construction, except as otherwise shown or specified.
- B. Upon completion of Contract, deliver Work complete and undamaged. Existing Work (walls, lawns, paving, roads, walks, etc.) disturbed or removed as a result of performing required new Work, shall be patched, repaired, reinstalled, or replaced with new Work, and refinished and left in as good condition as existed before commencing Work.
- C. At the Contractor's own expense, the Contractor shall immediately restore to service and repair any damage caused by the Contractor's workmen to existing piping, conduits, wires, cables, etc., of utility services or of fire protection systems and communications systems (including telephone) whether or not they are indicated on drawings and which are not scheduled for discontinuance or abandonment.
- D. Expense of repairs to such utilities and systems not shown on drawings or locations of which are unknown will be covered by adjustment to contract time and price in accordance with clause entitled "CHANGES" (FAR 52.243 4 and VAAR 852.236 88) and "DIFFERING SITE CONDITIONS" (FAR 52.236 2).

1.12 PHYSICAL DATA

- A. Data and information furnished or referred to below is for the Contractor's information. The Government shall not be responsible for any interpretation of or conclusion drawn from the data or information by the Contractor.
 - 1. The indications of physical conditions on the drawings and in the specifications are the result of site investigations by Jacobs Engineering Group Inc (topographic survey) and Stevens Ferrone and Bailey (Geotechnical Investigation).
(FAR 52.236 4)

- B. Subsurface conditions have been developed by core borings and test pits. Logs of subsurface exploration are shown diagrammatically on drawings.
- C. A copy of the soil report is available as an Appendix to these Specifications and shall be considered part of the contract documents.
- D. The Government does not guarantee that other materials will not be encountered nor that proportions, conditions or character of several materials will not vary from those indicated by explorations. Bidders are expected to examine the site of Work and logs of borings and, after investigation, decide for themselves the character of materials and make their Bids accordingly. Upon proper application to the Department of Veterans Affairs, Bidders will be permitted to make subsurface explorations of their own at site at their own expense.

1.13 PROFESSIONAL SURVEYING SERVICES

- A. A registered professional land surveyor or registered civil engineer, licensed to perform Work in the state of New Mexico, whose services are retained and paid for by the Contractor shall perform services specified herein and in other specification sections. The Contractor shall certify that the land surveyor or civil engineer is not one who is a regular employee of the Contractor, and that the land surveyor or civil engineer has no financial interest in this Contract.

1.14 LAYOUT OF WORK

- A. The Contractor shall lay out the Work from Government established base lines and bench marks indicated on the drawings, and shall be responsible for all measurements in connection with the layout. The Contractor shall furnish, at the Contractor's own expense, all stakes, templates, platforms, equipment, tools, materials, and labor required to lay out any part of the work. The Contractor shall be responsible for executing the Work to the lines and grades that may be established or indicated by the COTR. The Contractor shall also be responsible for maintaining and preserving all stakes and other marks established by the COTR until authorized to remove them. If such marks are destroyed by the Contractor or through Contractor's negligence before their removal is authorized, the COTR may replace them and deduct the expense of the replacement from any amounts due or to become due to the Contractor.

(FAR 52.236 17)

- B. Establish and plainly mark center lines for each building structure, lines for each gravesite control monument, and such other lines and grades that are reasonably necessary to properly assure that location, orientation, and elevations established for each such structure and/or addition, roads, parking lots, gravesite control monuments, are in accordance with lines and elevations shown on Contract Drawings.
- C. Following completion of general mass excavation and before any other permanent Work is performed, establish and plainly mark (through use of appropriate batter boards or other means) sufficient additional survey control points or system of points as may be necessary to assure proper alignment,

orientation, and grade of all major features of Work. The Survey shall include, but not be limited to, location of lines and grades of footings, exterior walls, center lines of columns in both directions, major utilities and elevations of floor slabs:

1. Such additional survey control points or system of points thus established shall be checked and certified by a registered land surveyor or registered civil engineer. Furnish such certification to the COTR before any Work is placed.
- D. During progress of Work, and particularly as Work progresses from area to area, the Contractor shall have line grades and plumbness of all major form Work checked and certified by a registered land surveyor or registered civil engineer as meeting requirements of Contract Drawings. Furnish such certification to the COTR before any major items of concrete Work are placed. In addition, the Contractor shall furnish to the COTR certificates from a registered land surveyor or registered civil engineer that the following work is complete in every respect as required by Contract Drawings.
1. Lines of each structure and/or addition.
 2. Elevations of bottoms of footings and tops of floors of each structure and/or addition.
 3. Lines and elevations of drains and of all outside distribution systems.
 4. Lines of elevations of all swales and interment areas.
 5. Lines and elevations of walks.
 6. Northing/Easting coordinate locations of all water, sanitary, storm, gas and irrigation structures, directional fittings, control wire and lines.
- E. Upon completion of the work, the Contractor shall furnish the COTR with reproducible drawings, in AutoCAD form, at the scale of the Contract Drawings, showing the finished grade on the grid developed for constructing the Work, including burial monuments and fifty foot stationing along new road centerlines. These drawings shall bear the seal of the registered land surveyor or registered civil engineer.
- F. The Contractor shall perform the surveying and layout work of this and other articles and specifications in accordance with the provisions of Article "Professional Surveying Services".

1.15 AS-BUILT DRAWINGS

- A. The Contractor shall maintain two full size sets of as-built drawings which will be kept current during construction of the project, which will include all Contract changes, modifications and clarifications.
- B. All variations shall be shown in the same general detail as used in the Contract Drawings. To insure compliance, as-built drawings shall be made available for the COTR's review, as often as requested.
- C. The Contractor shall deliver two approved completed sets of as-built drawings to the COTR within 15 calendar days after each completed phase and after the acceptance of the project by the COTR.
- D. Paragraphs A, B, & C shall also apply to all shop drawings.

1.16 USE OF ROADWAYS

- A. For hauling, use only established public roads and roads on Cemetery property and, when authorized by the COTR, such temporary roads which are necessary in the performance of contract Work. Temporary roads shall be constructed by the Contractor at the Contractor's expense. When necessary to cross curbing, sidewalks, or similar construction, they must be protected by well constructed bridges.
 - 1. Contractor may only use Cemetery roads upon approval from COTR. Contractor shall video document condition of roadways prior to construction and restore roadways to a condition equivalent to or better than existing condition at completion of construction.

1.17 TEMPORARY TOILETS

- A. Provide for use of all Contractor's workmen ample temporary sanitary toilet accommodations with suitable sewer and water connections, or when approved by COTR provide suitable dry closets where directed. Keep such places clean and free from flies, and all connections and appliances connected therewith are to be removed prior to completion of contract, and premises left perfectly clean.

1.18 AVAILABILITY AND USE OF UTILITY SERVICES

- A. The Government shall make all reasonably required amounts of utilities available to the Contractor from existing outlets and supplies, as specified in the Contract. The amount to be paid by the Contractor for chargeable electrical services shall be the prevailing rates charged to the Government. The Contractor shall carefully conserve any utilities furnished without charge.
 - 1. Temporary utility connections will be required to be metered and usage paid by the Contractor. If permits are required for temporary connections to utilities, the permits and costs thereof will be the responsibility of the Contractor.
- B. The Contractor, at Contractor's expense and in a workmanlike manner satisfactory to the COTR, shall install and maintain all necessary temporary connections and distribution lines, and all meters required to measure the amount of electricity used for the purpose of determining charges. Before final acceptance of the work by the Government, the Contractor shall remove all the temporary connections, distribution lines, meters, and associated paraphernalia.
- C. The Contractor shall install meters at the Contractor's expense and furnish the Cemetery a monthly record of the Contractor's usage of electricity as hereinafter specified.
- D. Electricity (for Construction and Testing): Furnish all temporary electric services.
 - 1. Obtain electricity by connecting to the Cemetery electrical distribution system. The Contractor shall meter and pay for electricity required for Work. Where not available the Contractor shall supply power via portable generators at Contractor's own expense.
- E. Water (for Construction and Testing): Furnish temporary water service.

1. Obtain water by connecting to the Cemetery water distribution system. Provide reduced pressure backflow preventer and meter at each connection. The Contractor shall pay for water required for Work. Where not available in the Cemetery, Contractor shall connect to and pay for permits, connection to, and use of municipal system.
2. Maintain connections, pipe, fittings and fixtures and conserve water use so none is wasted. Failure to stop leakage or other wastes will be cause for revocation of use of water from the Cemetery's system.

1.19 TESTS

- A. Conduct final tests required in various sections of specifications in presence of an authorized representative of the COTR. Contractor shall furnish all labor, materials, equipment, instruments, and forms, to conduct and record such tests. Conduct pre-test to ensure proper function of systems prior to scheduling final test.

1.20 RELOCATED ITEMS

- A. Contractor shall disconnect, dismantle as necessary, remove and reinstall in new location, all existing items indicated by symbol "R" or otherwise shown to be relocated by the Contractor.
- B. Perform relocation of such items at such times and in such a manner as directed by the COTR.
- C. Suitably cap existing service lines, such as water, drain, gas, air, and/or electrical, whenever such lines are disconnected from equipment to be relocated. Remove abandoned lines in finished areas and cap as specified herein before under paragraph "Abandoned Lines".
- D. All service lines such as noted above for relocated items shall be in place at point of relocation ready for use before any existing item is disconnected. Make relocated existing item ready for operation or use immediately after reinstallation.

1.21 CONSTRUCTION DIGITAL IMAGES

- A. During the construction period through completion, furnish Department of Veterans Affairs with digital images of construction progress each day.
 1. Normally such images of the site will be taken daily. However, the COTR may also direct the taking of special digital images at any time prior to completion and acceptance of Contract.

1.22 HISTORIC PRESERVATION

- A. Where the Contractor or any of the Contractor's employees, prior to, or during the construction Work, are advised of or discover any possible archeological, historical and/or cultural resources, the Contractor shall immediately notify the COTR verbally, and then with a written follow up. Work shall cease until COTR has determined archaeological significance and proceeding Work.

1.23 PROJECT HEALTH AND SAFETY PLAN

- A. Prior to commencing any construction, the Contractor shall submit a site specific Project Health and Safety Plan (PHSP). At a minimum, the PHSP shall cover the following topics:
1. Organizational structure (including Responsible Persons)
 2. Site Characterization and Job Hazard Identification
 3. Site Control and Security
 4. Training
 5. Medical Surveillance
 6. PPE
 7. Exposure Monitoring
 8. Heat Stress
 9. Spill Containment
 10. Decontamination
 11. Emergency Response
 12. Trench Safety

END OF SECTION

SECTION 01 32 17

NETWORK ANALYSIS SCHEDULES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The Contractor shall develop a Microsoft Project 2003 (or later) Gantt Chart (bar chart) schedule demonstrating fulfillment of the Contract requirements. The Contractor shall keep the network up-to-date in accordance with the requirements of this Section. The Contractor shall utilize the plan for scheduling, coordinating and monitoring Work under this Contract (including all activities of subcontractors, equipment vendors and suppliers). The Gantt Chart will be utilized to satisfy time applications.

1.2 CONTRACTOR'S REPRESENTATIVE:

- A. The Contractor shall designate an in-house representative who will be responsible to prepare the schedule, review the schedule and report progress of the project to the COTR.
- B. The Contractor's in-house representative shall be given authority to act on behalf of the Contractor in fulfilling the requirements of this specification Section. Such authority shall not be interrupted throughout the duration of the project.

1.3 COMPUTER PRODUCED SCHEDULES:

- A. The Contractor shall provide to CO/COTR monthly computer processing of all computer produced schedules generated from monthly project updates. The Contractor shall provide to CO/COTR two (2) copies of the updated Microsoft Project Gantt Chart and an electronic copy of this data. This must be submitted with and substantively support the Contractor's monthly payment request.
- B. The Contractor is responsible for the correctness and timeliness of the computer-produced reports. The Contractor is also responsible for the accurate and timely submittal of the updated project schedule.
- C. CO/COTR shall report errors in computer-produced reports to the Contractor's representative within ten (10) calendar days from receipt of reports. The Contractor shall reprocess the Gantt Chart and associated CDs, when requested by the Contracting Officer's Representative, to correct errors that affect the schedule for the project.

1.4 THE COMPLETE PROJECT GANTT CHART SUBMITTAL:

- A. The Complete Project Microsoft Project Gantt Chart will contain sufficient Work activities/events as necessary to fully detail the project schedule.

- B. Within ten (10) calendar days after receipt of the Notice to Proceed, the Contractor shall submit for the COTR's review, a Microsoft Project Gantt Chart and a CD. Each activity/event on the Gantt Chart schedule shall contain as a minimum, but not limited to, activity/event description, duration, start dates and finish dates, and baseline start and finish dates. Activity constraints, not required by the contract, will not be accepted. Logic events (non-Work) will be permitted where necessary to reflect proper sequence among Work events, but must have zero duration.
- C. The complete working Gantt Chart shall reflect the Contractor's approach to scheduling the complete project. The final Gantt Chart in its original form shall contain no Contract changes or delays that may have been incurred during the final Gantt Chart development period. It shall reflect the Contractors "AS BID" or "DAY 1" schedule. Changes and/or delays shall be entered at the first monthly update after the final Gantt Chart has been approved. The Contractor should provide their requests for time and supporting time extension analysis for Contract time as a result of Contract changes/delays, after this update, and in accordance with Article, ADJUSTMENT OF CONTRACT COMPLETION.
- D. Within ten (10) calendar days after receipt of the complete project Gantt Chart, the Contracting Officer (CO) or his representative, will do one or both of the following:
 - 1. Notify the Contractor concerning his actions, opinions, and objections.
 - 2. Schedule a meeting with the Contractor at, or near the job site, or via conference call, for joint review, correction or adjustment of the proposed plan. Within ten (10) calendar days after the joint review, the Contractor shall revise and shall submit two (2) copies of the revised Gantt Chart and a revised CD as specified to the CO/COTR. The revised submission will be reviewed by the CO and, if found to be as previously agreed upon, will be approved.

1.5 WORK ACTIVITY/EVENT AND COST DATA INFORMATION:

- A. The Contractor shall not be required to "cost load" the computerized Microsoft Project Gantt Chart. As part of this submission, the Contractor shall provide a separate Schedule of Costs on AIA document G703. This Schedule of Costs shall reflect and contain all the same activities/events identified on the Gantt Chart.
- B. The Contractor and the CO shall use this Schedule of Costs for monthly payment purposes as referenced in the General Conditions of this agreement.
- C. The Contractor and CO shall agree on percentages for monthly Work accomplished. The cumulative total amount of all cost loaded activities/events (including alternates) shall equal the total Contract price.
- D. Prorate overhead, profit and general conditions on all Work activities/events for the entire project. Negative Work activity/event cost data will not be acceptable, except on VA issued Contract changes.

1.6 GANTT CHART REQUIREMENTS:

- A. Show on the Gantt Chart the sequence and interdependence of Work activities/events required for complete performance of all items of Work. In preparing the Gantt Chart, the Contractor shall:
1. Show the following on each Work activity/event:
 - a. Concise description of the Work represented by the activity/event.
 - b. Duration (in work days).
 2. Show activities/events as:
 - a. Contractor's time required for submittal of shop drawings, templates, fabrication, delivery and similar pre-construction work.
 - b. COTR's and A/E's review and approval of shop drawings, equipment schedules, samples, template, or similar items.
 - c. Interruption of VA Cemetery utilities, delivery of Government furnished equipment, project phasing and any other specification requirements.
 - d. VA inspection and acceptance activity/event with a minimum duration of five (5) work days at the end of each phase and immediately preceding any VA move activity/event required by the Contract phasing for that phase.
 3. Break up the Work into activities/events of durations no longer than thirty (30) work days each, except as to non-construction activities/events (i.e., procurement of materials, delivery of equipment, concrete and asphalt curing) and any other activities/events for which the CO may approve the showing of a longer duration. The duration for VA approval of any required submittal, shop drawing, or other submittals shall not be less than ten (10) workdays. The construction time as determined by the Gantt Chart schedule from start to finish for any sub-phase, phase or the entire project shall not exceed the total Contract duration. Describe Work activities/events clearly, so the Work is readily identifiable for assessment of completion. Activities/events labeled "start," "continue," or "completion," are not specific and will not be allowed. Lead and lag time activities will not be acceptable.
 4. Exterior Label Information: Provide the following information on an external label attached to each diskette(s):
 - a. VA project number and project location.
 - b. Name and telephone number of a point of contact, preferably the person who created the schedule.
 - c. The CD number and total number of CDs in the set.
 - d. The project data status date.

1.7 PAYMENT TO THE CONTRACTOR:

- A. Monthly, the Contractor shall submit the Gantt Chart updated for remaining activity durations and a Schedule of Costs updated for costs. AIA application and certification for payment documents G702 and G703 will be used. The payment request should reflect and be in accordance with the provisions of the following Article, PAYMENT AND PROGRESS REPORTING, as the basis upon which progress payments will be made pursuant to Article, PAYMENT UNDER FIXED-PRICE CONSTRUCTION CONTRACTS of Section GENERAL

CONDITIONS. The Contractor is entitled to a monthly progress payment upon approval of estimates as determined from the currently approved updated Schedule of Costs unless, in special situations, the Contracting Officer permits an exception to this requirement. Monthly payment requests shall include: two (2) copies of the updated Microsoft Project Gantt Chart, a listing of all project schedule changes, and associated data, made at the update. These must be submitted with and substantively support the Contractor's monthly application and certificate for payment request documents.

1. Monthly updates to the Gantt Chart shall include a summary of changes in the form of baseline duration/start/end dates and current month's variance from baseline duration/start/end dates.
- B. When the Contractor fails or refuses to furnish to the CO the information and the associated updated Gantt Chart data, which, in the sole judgment of the CO, are necessary for validating the monthly progress payment, the Contractor shall not be deemed to have provided supporting schedule data upon which progress payment may be reasonably determined.

1.8 PAYMENT AND PROGRESS REPORTING:

- A. Monthly job site progress meetings shall be held on dates mutually agreed to by the CO (or COTR) and the Contractor. Presence of subcontractors during the progress meeting is optional unless required by the CO (or COTR). Job progress will be reviewed to verify:
1. Actual start and/or finish dates for updated/completed activities/events.
 2. Remaining duration, required to complete each activity/event started, or scheduled to start, but not completed.
 3. Time and cost data for change orders, and supplemental agreements that are to be incorporated into the Gantt Chart.
 4. Percentage for completed and partially completed activities/events.
 5. Logic and duration revisions required by this Section of the specifications.
 6. Activity/event duration and percent complete shall be updated independently.
- B. The Contractor shall submit a narrative report as a part of his monthly review and update, in a form agreed upon by the CO. The narrative report shall include a description of problem areas; current and anticipated delaying factors and their estimated impact on performance of other activities/events and completion dates; and an explanation of corrective action taken or proposed. This report is in addition to the daily reports pursuant to the provisions of Article, DAILY REPORT OF WORKERS AND MATERIALS in the GENERAL CONDITIONS.
- C. As part of the monthly jobsite progress meeting, the General Contractor, specifically requested subcontractors and the COTR shall meet to discuss the monthly updated schedule. The main emphasis shall be to address Work activities to avoid slippage of project schedule and to identify any necessary actions required to maintain project schedule during the reporting period.

1.9 RESPONSIBILITY FOR COMPLETION:

- A. Whenever it becomes apparent from the monthly progress review meeting or the monthly computer-produced Gantt Chart schedule that phasing or Contract completion dates will not be met, the Contractor shall execute some or all of the following remedial actions:
 - 1. Increase construction manpower in such quantities and crafts as necessary to eliminate the backlog of work.
 - 2. Increase the number of working hours per shift, shifts per working day, working days per week, the amount of construction equipment, or any combination of the foregoing to eliminate the backlog of work.
 - 3. Reschedule the Work in conformance with the specification requirements.
- B. Prior to proceeding with any of the above actions, the Contractor shall notify and obtain approval from the CO for the proposed schedule changes. If such actions are approved, the revisions shall be incorporated by the Contractor into the Gantt Chart before the next update, at no additional cost to the Government.

1.10 CHANGES TO GANTT CHART SCHEDULE:

- A. Within ten (10) calendar days after VA acceptance and approval of any updated computer-produced schedule, the Contractor shall submit a revised Gantt Chart, the associated CDs, and a list of any activity/event changes including predecessors and successors for any of the following reasons:
 - 1. Delay in completion of any activity/event or group of activities/events, which indicate an extension of the project completion by twenty (20) working days or 10 percent of the remaining project duration, whichever is less. Such delays which may be involved with Contract changes, strikes, unusual weather, and other delays will not relieve the Contractor from the requirements specified unless the conditions are shown on the Gantt Chart as the direct cause for delaying the project beyond the acceptable limits.
 - 2. Delays in submittals, or deliveries, or Work stoppage are encountered which make rescheduling of the Work necessary.
 - 3. The schedule does not represent the actual prosecution and progress of the project.
 - 4. When there is, or has been, a substantial revision to the activity/event costs of the network diagram regardless of the cause for these revisions.
- B. Revisions made under this paragraph, which affect the previously approved computer-produced schedules for Government furnished equipment, Contract phase(s) and sub phase(s), utilities furnished by the Government to the Contractor, or any other previously contracted item, must be furnished in writing to the CO for approval.
- C. CO's approval for the revised Gantt Chart and all relevant data is contingent upon compliance with all other paragraphs of this Section and any other previous agreements by the CO or the COTR.
- D. The cost of revisions to the Gantt Chart resulting from Contract changes will be included in the cost of the change.

- E. The cost of revisions to the Gantt Chart not resulting from Contract changes is the responsibility of the Contractor.

1.11 ADJUSTMENT OF CONTRACT COMPLETION:

- A. The Contract completion time will be adjusted only for causes specified in this contract. Request for an extension of the Contract completion date by the Contractor shall be supported with a justification, Gantt Chart data and supporting evidence as the CO may deem necessary for determination as to whether or not the Contractor is entitled to an extension of time under the provisions of the contract. Submission of proof based on revised activity/event logic, durations (in work days) and costs is obligatory to any approvals.
- B. The CO's determination as to the total number of days of Contract extension will be based upon the current computer-produced Gantt Chart schedule for the time period when the change took place and all other relevant information. The CO will, within thirty (30) calendar days after receipt of such justification and supporting evidence, advise the Contractor in writing of his decision on the matter.
- C. The Contractor shall submit each request for a change in the Contract completion date to the Contracting Officer in accordance with the provisions specified under Article, CHANGES, in the Section, GENERAL CONDITIONS. The Contractor shall include, as a part of each change order proposal, a sketch showing all revisions, duration (in work days) changes, and cost changes, for Work in question and its relationship to other activities on the approved network diagram.
- D. All delays due to non-Work activities/events such as RFI's, WEATHER, STRIKES, and similar non-Work activities/events shall be analyzed on a month by month basis.

END OF SECTION

SECTION 01 33 23

SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

PART 1 - GENERAL

- 1.1 Refer to Articles titled SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (FAR 52.236-21) and, SPECIAL NOTES (VAAR 852.236-91), in GENERAL CONDITIONS.
- 1.2 For the purposes of this Contract, samples, including laboratory samples to be tested, test reports, certificates, and manufacturers' literature and data shall also be subject to the previously referenced requirements. The following text refers to all items collectively as SUBMITTALS.
- 1.3 Submit for approval, all of the items specifically mentioned under the separate Sections of the specification, with information sufficient to evidence full compliance with Contract requirements. Materials, fabricated articles and the like to be installed in permanent Work shall equal those of approved submittals. After an item has been approved, no change in brand or make will be permitted unless:
 - A. Satisfactory written evidence is presented to, and approved by CO, that manufacturer cannot make scheduled delivery of approved item, or;
 - B. Item delivered has been rejected and substitution of a suitable item is an urgent necessity, or;
 - C. Other conditions become apparent which indicates approval of such substitute item to be in best interest of the Government.
- 1.4 Forward submittals in sufficient time to permit proper consideration and approval action by Government. Time submission to assure adequate lead time for procurement of Contract-required items. Delays attributable to untimely and rejected submittals (including any laboratory samples or testing) will not serve as a basis for extending Contract time for completion.
- 1.5 Submittals will be reviewed for compliance with Contract requirements by A/E, and action thereon will be taken by COTR on behalf of the CO.
- 1.6 Upon receipt of submittals, COTR will assign a file number thereto. Contractor, in any subsequent correspondence, shall refer to this file and identification number to expedite replies relative to previously approved or disapproved submittals.
- 1.7 The Government reserves the right to require additional submittals, whether or not particularly mentioned in this Contract. If additional submittals beyond those required by the Contract are furnished pursuant to request therefore by CO, adjustment in Contract price and time will be made in accordance with Articles titled CHANGES (FAR 52.243-4) and CHANGES - SUPPLEMENT (VAAR 852.236-88) of the GENERAL CONDITIONS.

- 1.8 Schedules called for in Specifications and shown on shop drawings shall be submitted for use and information of Department of Veterans Affairs and A/E. However, the Contractor shall assume responsibility for coordinating and verifying schedules. The CO and A/E assume no responsibility for checking schedules or layout drawings for exact sizes, exact numbers and detailed positioning of items.
- 1.9 Submittals must be submitted by Contractor only and shipped prepaid. CO assumes no responsibility for checking quantities or exact numbers included in such submittals.
- A. Submit samples in single units unless otherwise specified. Submit shop drawings, schedules, manufacturers' literature and data, and certificates in quadruplicate, except where a greater number is specified.
- B. Submittals will receive consideration only when covered by a transmittal letter signed by Contractor. Letter shall be sent via first class mail and shall contain the list of items, name of Cemetery, name of Contractor, Contract number, applicable specification paragraph numbers, applicable drawing numbers (and other information required for exact identification of location for each item), manufacturer and brand, ASTM or Federal Specification Number (if any) and such additional information as may be required by specifications for particular item being furnished. In addition, catalogs shall be marked to indicate specific items submitted for approval.
1. A copy of letter must be enclosed with items, and any items received without identification letter will be considered "unclaimed goods" and held for a limited time only.
 2. Each sample, certificate, manufacturers' literature and data shall be labeled to indicate the name and location of the Cemetery, name of Contractor, manufacturer, brand, Contract number and ASTM or Federal Specification Number and Paragraph Numbers as applicable and location(s) on project.
 3. Required certificates shall be signed by an authorized representative of manufacturer or supplier of material, and by Contractor.
 4. Submittals shall be made for full Sections. Partial Section submittals or combined Section submittals will be rejected and required to be re-submitted per Contract requirements.
 5. Submittals that do not include material samples may be made electronically via email or upload to ftp website.
- C. In addition to complying with the applicable requirements specified in preceding Article 1.9, samples which are required to have Laboratory Tests shall be tested, at the expense of Contractor, in a commercial laboratory approved by CO.
1. Laboratory shall furnish CO with a certificate stating that it is fully equipped and qualified to perform intended Work, is fully acquainted with specification requirements and intended use of materials and is an independent establishment in no way connected with organization of Contractor or with manufacturer or supplier of materials to be tested.
 2. Certificates shall also set forth a list of comparable projects upon which laboratory has performed similar functions during past five years.
 3. Samples and laboratory tests shall be sent directly to approved commercial testing laboratory.

4. Contractor shall send a copy of transmittal letter to both COTR and to A/E simultaneously with submission of material to a commercial testing laboratory.
 5. Laboratory test reports shall be sent directly to COTR for appropriate action.
 6. Laboratory reports shall list Contract specification test requirements and a comparative list of the laboratory test results. When tests show that the material meets specification requirements, the laboratory shall so certify on test report.
 7. Laboratory test reports shall also include a recommendation for approval or disapproval of tested item.
- D. If submittal samples have been disapproved, resubmit new samples as soon as possible after notification of disapproval. Such new samples shall be marked "Resubmitted Sample" in addition to containing other previously specified information required on label and in transmittal letter.
- E. Approved samples will be kept on file by the COTR at the site until completion of contract, at which time such samples will be delivered to Contractor as Contractor's property. Where noted in technical Sections of specifications, approved samples in good condition may be used in their proper locations in Contract Work. At completion of Contract, samples that are not approved will be returned to Contractor only upon request and at Contractor's expense. Such request should be made prior to completion of the Contract. Disapproved samples that are not requested for return by Contractor will be discarded after completion of Contract.
- F. Submittal drawings (shop, erection or setting drawings) and schedules, required for Work of various trades, shall be checked before submission by technically qualified employees of Contractor for accuracy, completeness and compliance with Contract requirements. These drawings and schedules shall be stamped and signed by Contractor certifying to such check.
1. Each drawing shall have marked thereon, proper descriptive title, including Cemetery location, project number, manufacturer's number, reference to Contract drawing number, detail Section Number, and Specification Section Number.
 2. A space 4-3/4 by 5 inches shall be reserved on each drawing to accommodate approval or disapproval stamp.
 3. When Work is directly related and involves more than one trade, shop drawings shall be submitted to A/E under one cover.
- 1.10 Samples, shop drawings, test reports, certificates and manufacturers' literature and data, shall be submitted for approval to:
- JACOBS ENGINEERING GROUP INC
180 Promenade Circle, Suite 300
Sacramento, California 95834
ATTN: SFNC Project Manager
Phone: 916.929.3323

- A. Digital Submittals: Digital submittals will be permitted only after the Contractor has demonstrated that the process can be accommodated within the limits of the VA and A/E network limitations.
- 1.11 At the time of transmittal to the A/E, the Contractor shall also send a copy of the complete submittal directly to the COTR.

Department of Veterans Affairs
Memorial Service Network III
155 Van Gordon Street, Suite 510
Lakewood, CO 80228
ATTN: Mr. Rodney Duich
Phone: 303.914.5702

END OF SECTION

SECTION 01 45 29

TESTING LABORATORY SERVICES – RETAINED BY CONTRACTOR

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section specifies materials testing activities and inspection services required during project construction to be provided by a Testing Laboratory retained and paid for by Contractor.

1.2 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. Use the latest edition of the referenced publication.
- B. American Association of State Highway and Transportation Officials (AASHTO):
- T27 Sieve Analysis of Fine and Coarse Aggregates
 - T96 Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
 - T99 The Moisture-Density Relations of Soils Using a 2.5 Kg (5.5 lb.) Rammer and a 305 mm (12 in.) Drop
 - T104 Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate
 - T180 Moisture-Density Relations of Soils using a 4.54 kg (10 lb.) Rammer and a 457 mm (18 in.) Drop
 - T191 Density of Soil In-Place by the Sand-Cone Method
- C. American Society for Testing and Materials (ASTM):
- A325 Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
 - A370 Definitions for Mechanical Testing of Steel Products
 - A490 Heat Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength
 - C31 Making and Curing Concrete Test Specimens in the Field
 - C33 Concrete Aggregates
 - C39 Compressive Strength of Cylindrical Concrete Specimens
 - C109 Compressive Strength of Hydraulic Cement Mortars
 - C138 Unit Weight, Yield, and Air Content (Gravimetric) of Concrete
 - C140 Sampling and Testing Concrete Masonry Units and Related Units
 - C143 Slump of Hydraulic Cement Concrete
 - C172 Sampling Freshly Mixed Concrete
 - C173 Air Content of freshly Mixed Concrete by the Volumetric Method

C330.....	Lightweight Aggregates for Structural Concrete
C567.....	Density Structural Lightweight Concrete
C780.....	Pre-construction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
C1019.....	Sampling and Testing Grout
C1064.....	Freshly Mixed Portland Cement Concrete
C1077.....	Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
C1314.....	Compressive Strength of Masonry Prisms
D698.....	Laboratory Compaction Characteristics of Soil Using Standard Effort
D1556.....	Density and Unit Weight of Soil in Place by the Sand- Cone Method
D1557.....	Laboratory Compaction Characteristics of Soil Using Modified Effort
D2166.....	Unconfined Compressive Strength of Cohesive Soil
D2216.....	Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
D2974.....	Moisture, Ash, and Organic Matter of Peat and Other Organic Soils
D6938.....	Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
E94.....	Radiographic Testing
E164.....	Ultrasonic Contact Examination of Weldments
E329.....	Agencies Engaged in Construction Inspection and/or Testing
E543.....	Agencies Performing Non-Destructive Testing
E709.....	Guide for Magnetic Particle Examination
E1155.....	Determining FF Floor Flatness and FL Floor Levelness Numbers

- D. American Welding Society (AWS):
D1.1-07..... Structural Welding Code-Steel

1.3 REQUIREMENTS

- A. Accreditation Requirements: Testing Laboratory retained and paid for by Contractor must be accredited by one or more of the National Voluntary Laboratory Accreditation Program (NVLAP) programs acceptable in the geographic region for the project. Furnish to the COTR a copy of the Certificate of Accreditation and Scope of Accreditation. For testing laboratories that have not yet obtained accreditation by a NVLAP program, submit an acknowledgement letter from one of the laboratory accreditation authorities indicating that the application for accreditation has been received and the accreditation process has started, and submit to the COTR for approval, certified statements, signed by an official of the testing laboratory attesting that the proposed laboratory, meets or conforms to the ASTM standards listed below as appropriate to the testing field.
1. Laboratories engaged in testing of construction materials shall meet the requirements of ASTM E329.

2. Laboratories engaged in testing of concrete and concrete aggregates shall meet the requirements of ASTM C1077.
 3. Laboratories engaged in testing of soil and rock, as used in engineering design and construction, shall meet the requirements of ASTM D3740.
 4. Laboratories engaged in inspection and testing of steel, stainless steel, and related alloys will be evaluated according to ASTM A880.
 5. Laboratories engaged in non-destructive testing (NDT) shall meet the requirements of ASTM E543.
 6. Laboratories engaged in Hazardous Materials Testing shall meet the requirements of OSHA and EPA.
- B. Inspection and Testing: Testing laboratory shall inspect materials and workmanship and perform tests described herein and additional tests requested by COTR. When it appears materials furnished or Work performed by Contractor fail to meet construction Contract requirements, Testing Laboratory shall direct attention of COTR to such failure.
- C. Written Reports: Testing laboratory shall submit test reports to COTR, A/E, and Contractor within 24 hours after each test is completed unless other arrangements are agreed to in writing by the COTR. Submit reports of tests that fail to meet construction Contract requirements on colored paper.
- D. Verbal Reports: Give verbal notification to COTR immediately of any irregularity.

1.4 CONTRACTOR SUBMITTALS

- A. Prior to start of Work, submit testing laboratory name, address, and telephone number, and names of full time registered Engineer and responsible officer.
- B. Submit copy of report of laboratory facilities inspection made by Materials Reference Laboratory of National Bureau of Standards during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.

1.5 TESTING AGENCY/LABORATORY RESPONSIBILITIES

- A. Test samples of mixes submitted by Contractor.
- B. Provide qualified personnel at site. Cooperate with COTR and Contractor in performance of services.
- C. Perform specified sampling and testing of Products in accordance with specified standards.
- D. Ascertain compliance of materials and mixes with requirements of Contract Documents.
- E. Promptly notify COTR and Contractor of observed irregularities or non-conformance of Work or Products.
- F. Perform additional tests required by COTR.

- G. Attend preconstruction meetings and progress meetings.

1.6 TESTING AGENCY/LABORATORY REPORTS

- A. After each test, promptly submit two copies of report to COTR, A/E, and Contractor.
- B. Include:
 - 1. Date issued.
 - 2. Project title and number.
 - 3. Name of inspector.
 - 4. Date and time of sampling or inspection.
 - 5. Identification of product and specifications Section.
 - 6. Location in the Project.
 - 7. Type of inspection or test.
 - 8. Date of test.
 - 9. Results of tests.
 - 10. Conformance with Contract Documents.
- C. When requested by COTR, provide interpretation of test results.

1.7 LIMITS ON TESTING AGENCY/LABORATORY AUTHORITY

- A. Testing agency or laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.
- B. Testing agency or laboratory may not approve or accept any portion of the Work.
- C. Testing agency or laboratory may not assume any duties of Contractor.
- D. Testing agency or laboratory has no authority to stop the Work.

1.8 CONTRACTOR RESPONSIBILITIES

- A. Deliver to testing agency/laboratory at designated location, adequate samples of materials proposed to be used which require testing, along with proposed mix designs.
- B. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
- C. Provide incidental labor and facilities:
 - 1. To provide access to Work to be tested.
 - 2. To obtain and handle samples at the site or at source of products to be tested.
 - 3. To facilitate tests.
 - 4. To provide storage and curing of test samples.
- D. Notify COTR, A/E, and Laboratory 24 hours prior to expected time for operations requiring testing services.

- E. Employ services of an independent qualified testing laboratory and pay for additional samples and tests required by Contractor beyond specified requirements.

1.9 SCHEDULE OF TESTS

- A. Individual Specification Sections: Tests required and standards for testing.
- B. Summary of Tests required are shown in Part 3. The approximate numbers of tests are shown for reference only. Contractor shall provide sufficient number of tests to satisfy Testing requirements.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EARTHWORK

- A. General: The Testing Laboratory shall provide qualified personnel, materials, equipment, and transportation as required to perform the services identified/required herein, within the agreed to schedule and/or time frame. The Work to be performed shall be as identified herein and shall include but not be limited to the following:
 - 1. Observe fill and subgrades during proof-rolling to evaluate suitability of surface material to receive fill or base course. Provide recommendations to the COTR regarding suitability or unsuitability of areas where proof-rolling was observed. Where unsuitable results are observed, witness excavation of unsuitable material and recommend to COTR extent of removal and replacement of unsuitable materials and observe proof-rolling of replaced areas until satisfactory results are obtained.
 - 2. Provide full time observation of fill placement and compaction and field density testing in building areas and provide part time observation of fill placement and compaction and field density testing in pavement areas to verify that earthwork compaction obtained is in accordance with Contract Documents.
 - 3. Provide supervised geotechnical technician to inspect excavation, subsurface preparation, and backfill for structural fill.
- B. Testing Compaction:
 - 1. Determine maximum density and optimum moisture content for each type of fill, backfill and subgrade material used, in compliance with ASTM D698, and in no case fewer than three (3) tests.
 - 2. Make field density tests in accordance with the primary testing method following ASTM D6938 wherever possible. Field density tests utilizing ASTM D1556 or ASTM D2167 shall be utilized on a case by case basis only if there are problems with the validity of the results from the primary method due to specific site field conditions. Should the testing laboratory propose these alternative methods, they should provide satisfactory explanation to the COTR before the tests are conducted.

- a. Foundation Wall Backfill: One test per 100 feet of each layer of compacted fill but in no case fewer than three (3) tests.
 - b. Sidewalk: One test for each 300 feet, but in no case fewer than two (2) tests.
 - c. Trenches: One test at maximum 100 foot intervals per 2 foot of vertical lift and at changes in required density, but in no case fewer than two (2) tests for each type of utility trench.
 - d. Footing Subgrade: At least one test for each layer of soil on which footings will be placed. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with related tested subgrade when acceptable to COTR. In each compacted fill layer below wall footings, perform one field density test for every 100 feet of wall. Verify subgrade is level, all loose or disturbed soils have been removed, and correlate actual soil conditions observed with those indicated by test borings.
- C. Testing for Footing Bearing Capacity: Evaluate if suitable bearing capacity material is encountered in footing subgrade.
- D. Testing Materials: Test suitability of on-site and off-site borrow as directed by COTR.

3.2 SITE WORK CONCRETE

- A. Test site work concrete including materials for concrete as required in Article CONCRETE of this Section.

3.3 CONCRETE

- A. Batch Plant Inspection and Materials Testing:
- 1. Perform continuous batch plant inspection until concrete quality is established to satisfaction of COTR with concurrence of Contracting Officer and perform periodic inspections thereafter as determined by COTR.
 - 2. Periodically inspect and test batch proportioning equipment for accuracy and report deficiencies to COTR.
 - 3. Sample and test mix ingredients as necessary to insure compliance with specifications.
 - 4. Sample and test aggregates daily and as necessary for moisture content. Test the dry rodded weight of the coarse aggregate whenever a sieve analysis is made, and when it appears there has been a change in the aggregate.
 - 5. Certify, in duplicate, ingredients and proportions and amounts of ingredients in concrete conform to approved trial mixes. When concrete is batched or mixed off immediate building site, certify (by signing, initialing or stamping thereon) on delivery slips (duplicate) that ingredients in truck-load mixes conform to proportions of aggregate weight, cement factor, and water-cement ratio of approved trial mixes.
- B. Field Inspection and Materials Testing:

1. Provide a technician at site of placement at all times to perform concrete sampling and testing.
2. Review the delivery tickets of the ready-mix concrete trucks arriving on-site. Notify the Contractor if the concrete cannot be placed within the specified time limits or if the type of concrete delivered is incorrect. Reject any loads that do not comply with the Specification requirements. Rejected loads are to be removed from the site at the Contractor's expense. Any rejected concrete that is placed will be subject to removal.
3. Take concrete samples at point of placement in accordance with ASTM C172. Mold and cure compression test cylinders in accordance with ASTM C31. Make at least three cylinders for each 100 cubic yards or less of each concrete type, and at least three cylinders for any one day's pour for each concrete type. Label each cylinder with an identification number. COTR may require additional cylinders to be molded and cured under job conditions.
4. Perform slump tests in accordance with ASTM C143. Test the first truck each day, and every time test cylinders are made. Test pumped concrete at the hopper and at the discharge end of the hose at the beginning of each day's pumping operations to determine change in slump.
5. Determine the air content of concrete per ASTM C173. For concrete required to be air-entrained, test the first truck and every 100 cubic yards thereafter each day. For concrete not required to be air-entrained, test every 100 cubic yards at random. For pumped concrete, initially test concrete at both the hopper and the discharge end of the hose to determine change in air content.
6. If slump or air content fall outside specified limits, make another test immediately from another portion of same batch.
7. Perform unit weight tests in compliance with ASTM C138 for normal weight concrete and ASTM C567 for lightweight concrete. Test the first truck and each time cylinders are made.
8. Notify laboratory technician at batch plant of mix irregularities and request materials and proportioning check.
9. Verify that specified mixing has been accomplished.
10. Environmental Conditions: Determine the temperature per ASTM C1064 for each truckload of concrete during hot weather and cold weather concreting operations:
 - a. When ambient air temperature falls below 40 degrees F, record maximum and minimum air temperatures in each 24 hour period; record air temperature inside protective enclosure; record minimum temperature of surface of hardened concrete.
 - b. When ambient air temperature rises above 85 degrees F, record maximum and minimum air temperature in each 24 hour period; record minimum relative humidity; record maximum wind velocity; record maximum temperature of surface of hardened concrete.
11. Inspect the reinforcing steel placement, including bar size, bar spacing, top and bottom concrete cover, proper tie into the chairs, and grade of steel prior to concrete placement. Submit detailed report of observations.
12. Observe conveying, placement, and consolidation of concrete for conformance to specifications.
13. Observe condition of formed surfaces upon removal of formwork prior to repair of surface defects and observe repair of surface defects.

14. Observe curing procedures for conformance with specifications, record dates of concrete placement, start of preliminary curing, start of final curing, end of curing period.
15. Observe preparations for placement of concrete:
 - a. Inspect handling, conveying, and placing equipment, inspect vibrating and compaction equipment.
 - b. Inspect preparation of construction, expansion, and isolation joints.
16. Observe preparations for protection from hot weather, cold weather, sun, and rain, and preparations for curing.
17. Observe concrete mixing:
 - a. Monitor and record amount of water added at project site.
 - b. Observe minimum and maximum mixing times.
18. Other inspections:
 - a. Grouting anchor bolts and reinforcing steel in hardened concrete.

C. Laboratory Tests of Field Samples:

1. Test compression test cylinders for strength in accordance with ASTM C39. For each test series, test one cylinder at 7 days and one cylinder at 28 days. Use remaining cylinder as a spare tested as directed by COTR. Compile laboratory test reports as follows: Compressive strength test shall be result of one cylinder, except when one cylinder shows evidence of improper sampling, molding or testing, in which case it shall be discarded and strength of spare cylinder shall be used.
2. Make weight tests of hardened lightweight structural concrete in accordance with ASTM C567.
3. Furnish certified compression test reports (duplicate) to COTR. In test report, indicate the following information:
 - a. Cylinder identification number and date cast.
 - b. Specific location at which test samples were taken.
 - c. Type of concrete, slump, and percent air.
 - d. Compressive strength of concrete in psi.
 - e. Weight of lightweight structural concrete in pounds per cubic feet.
 - f. Weather conditions during placing.
 - g. Temperature of concrete in each test cylinder when test cylinder was molded.
 - h. Maximum and minimum ambient temperature during placing.
 - i. Ambient temperature when concrete sample in test cylinder was taken.
 - j. Date delivered to laboratory and date tested.

3.4 REINFORCEMENT

- A. Review mill test reports furnished by Contractor.
- B. Perform sampling at fabricating plant. Take two samples from each 25 tons or fraction thereof of each size of reinforcing steel No. 3 thru No. 18.
- C. Make one tensile and one bend test in accordance with ASTM A370 from each pair of samples obtained.

- D. Written report shall include, in addition to test results, heat number, manufacturer, type and grade of steel, and bar size.
- E. Perform tension tests of mechanical and welded splices in accordance with ASTM A370.

3.5 ARCHITECTURAL PRECAST CONCRETE

- A. Inspection at Plant: Forms, placement of reinforcing steel, concrete cover, and placement and finishing of concrete.
- B. Concrete Testing: Test concrete including materials for concrete as required in Article CONCRETE of this section, except make two test cylinders for each day's production of each strength of concrete produced.
- C. Inspect members to insure specification requirements for curing and finishes have been met.

3.6 MASONRY

- A. Mortar Tests:
 - 1. Laboratory compressive strength test:
 - a. Comply with ASTM C780.
 - b. Obtain samples during or immediately after discharge from batch mixer.
 - c. Furnish molds with 2 inch, 3 compartment gang cube.
 - d. Test one sample at 7 days and 2 samples at 28 days.
 - 2. Two tests during first week of operation; one test per week after initial test until masonry completion.
- B. Grout Tests:
 - 1. Laboratory compressive strength test:
 - a. Comply with ASTM C1019.
 - b. Test one sample at 7 days and 2 samples at 28 days.
 - c. Perform test for each 2500 square feet of masonry.
- C. Masonry Unit Tests:
 - 1. Laboratory Compressive Strength Test:
 - a. Comply with ASTM C140.
 - b. Test 3 samples for each 5000 square feet of wall area.

3.7 STRUCTURAL STEEL

- A. General: Provide shop and field inspection and testing services to certify structural steel work is done in accordance with Contract documents. Welding shall conform to AWS D1.1 Structural Welding Code.
- B. Prefabrication Inspection:
 - 1. Review design and shop detail drawings for size, length, type and location of all welds to be made.

2. Approve welding procedure qualifications either by pre-qualification or by witnessing qualifications tests.
3. Approve welder qualifications by certification or retesting.
4. Approve procedure for control of distortion and shrinkage stresses.
5. Approve procedures for welding in accordance with applicable Sections of AWS D1.1.

C. Fabrication and Erection:

1. Weld Inspection:
 - a. Inspect welding equipment for capacity, maintenance and working condition.
 - b. Verify specified electrodes and handling and storage of electrodes in accordance with AWS D1.1.
 - c. Inspect preparation and assembly of materials to be welded for conformance with AWS D1.1.
 - d. Inspect preheating and interpass temperatures for conformance with AWS D1.1.
 - e. Measure 25 percent of fillet welds.
 - f. Welding Magnetic Particle Testing: Test in accordance with ASTM E709 for a minimum of:
 - 1) 20 percent of all shear plate fillet welds at random, final pass only.
 - 2) 20 percent of all continuity plate and bracing gusset plate fillet welds, at random, final pass only.
 - g. Verify that corrections of rejected welds are made in accordance with AWS D1.1.
 - h. Testing and inspection do not relieve the Contractor of the responsibility for providing materials and fabrication procedures in compliance with the specified requirements.
2. Bolt Inspection:
 - a. Inspect high-strength bolted connections in accordance AISC Specifications for Structural Joints Using ASTM A325 or A490 Bolts.
 - b. Slip-Critical Connections: Inspect 10 percent of bolts, but not less than 2 bolts, selected at random in each connection in accordance with AISC Specifications for Structural Joints Using ASTM A325 or A490 Bolts. Inspect all bolts in connection when one or more are rejected.
 - c. Fully Pre-tensioned Connections: Inspect 10 percent of bolts, but not less than 2 bolts, selected at random in 25 percent of connections in accordance with AISC Specification for Structural Joints Using ASTM A325 or A490 Bolts. Inspect all bolts in connection when one or more are rejected.
 - d. Bolts installed by turn-of-nut tightening may be inspected with calibrated wrench when visual inspection was not performed during tightening.
 - e. Snug Tight Connections: Inspect 10 percent of connections verifying that plies of connected elements have been brought into snug contact.
 - f. Inspect field erected assemblies; verify locations of structural steel for plumbness, level, and alignment.

- D. Submit inspection reports, record of welders and their certification, and identification, and instances of noncompliance to COTR.

3.8 TYPE OF TEST

	Approximate Number of Tests Required
A. Earthwork:	
Laboratory Compaction Test, Soils (ASTM D698)	3
Field Density, Soils (ASTM D6938)	13
B. Concrete:	
Making and Curing Concrete Test Cylinders (ASTM C31)	3
Compressive Strength, Test Cylinders (ASTM C39)	3
Concrete Slump Test (ASTM C143)	2
Concrete Air Content Test (ASTM C173)	2
Aggregate, Normal Weight:	
Gradation (ASTM C33)	1 for each type
Deleterious Substances (ASTM C33)	1 for each type
Soundness (ASTM C33)	1 for each type
Abrasion (ASTM C33)	1 for each type
Unit Weight (ASTM C330)	3
C. Reinforcing Steel:	
Tensile Test (ASTM A370)	2
Bend Test (ASTM A370)	2
Mechanical Splice (ASTM A370)	
Welded Splice Test (ASTM A370)	
D. Masonry:	
Making and Curing Test Cubes (ASTM C109)	3
Compressive Strength, Test Cubes (ASTM C109)	3
Sampling and Testing Mortar, Comp. Strength (ASTM C780)	3
Sampling and Testing Grout, Comp. Strength (ASTM C1019)	3
Masonry Unit, Compressive Strength (ASTM C140)	3
E. Structural Steel:	
Magnetic Particle Testing of Welds (ASTM E709)	4
F. Pressure Grouting:	
Standard Penetration Resistance Testing	4 Borings, 28 Tests

END OF SECTION

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SECTION 01 57 19

TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The Work of this Section specifies the control of environmental pollution and damage that the Contractor must consider for air, water, and land resources. It includes management of visual aesthetics, noise, and solid waste, as well as other pollutants and resources encountered or generated by the Contractor. The Contractor is obligated to consider specified control measures with the costs included within the various Contract items of Work.
- B. Environmental pollution and damage is defined as the presence of chemical, physical, or biological elements or agents which:
 - 1. Adversely affect human health or welfare.
 - 2. Unfavorably alter ecological balances of importance to human life.
 - 3. Affect other species of importance to humankind.
 - 4. Degrade the utility of the environment for aesthetic, cultural, and historical purposes.

1.2 DEFINITIONS OF POLLUTANTS

- A. Chemical Waste: Petroleum products, bituminous materials, salts, acids, alkalis, herbicides, pesticides, organic chemicals, and inorganic wastes.
- B. Debris: Combustible and noncombustible wastes, such as leaves, tree trimmings, ashes, and waste materials resulting from construction or maintenance and repair work.
- C. Sediment: Soil and other debris that has been eroded and transported by runoff water.
- D. Solid Waste: Rubbish, debris, garbage, and other discarded solid materials resulting from project construction activities.
- E. Surface Discharge: The term "Surface Discharge" implies that the water is discharged with possible sheeting action and subsequent soil erosion may occur. Waters that are surface discharged may terminate in drainage ditches, storm sewers, creeks, and/or "waters of the United States" and require a permit to discharge water from the governing agency.
- F. Rubbish: Combustible and noncombustible wastes such as, but not limited to, paper, plastic, metal and plastic containers and cans, boxes, metal and lumber scrap.
- G. Sanitary Wastes: Domestic Sanitary Sewage.

1.3 QUALITY CONTROL

- A. Contractor shall establish and maintain quality control for the environmental protection of all items set forth herein.
- B. Contractor shall record on daily reports any problems in complying with laws, regulations, and ordinances and note any corrective action taken.

1.4 REFERENCES

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.
- B. U.S. National Archives and Records Administration (NARA):
33 CFR 328 Definitions, Waters of the United States.
- C. Federal Environmental Regulatory Requirements: Comply with applicable regulations. The following is for Contractor's information only:
 - 1. Storm water permits; refer to The Office of Wastewater Management, NPDES Storm Water Program: <http://www.epa.gov/npdes/stormwater>
 - 2. Dredge and fill (Section 404) permits; refer to U.S. EPA Office of Wetlands, Oceans, and Watersheds (OWOW): <http://www.epa.gov/owow/>
 - 3. RCRA hazardous and non-hazardous solid waste requirements; refer to EPA's Office of Solid Waste and Emergency Response: <http://www.epa.gov/epaoswer/osw/laws-reg.htm>
 - 4. Oil spill requirements for construction activities; refer to EPA Oil Program web site: <http://www.epa.gov/oilspill/>
 - 5. Hazardous substances (Superfund Liability) requirements for construction activities; refer to EPA's Superfund website: <http://www.epa.gov/superfund/index.htm>
 - 6. Polychlorinated Biphenyl (PCB) waste requirements; refer to EPA's Polychlorinated Biphenyl (PCB) Homepage: <http://www.epa.gov/pcb/>
 - 7. Air quality requirements for construction activities; refer to EPA'S Air Program Mobile Sources Page: <http://www.epa.gov/ebtpages/airmobilesources.html>
 - 8. Asbestos requirements for construction activities; refer to EPA's Asbestos Management and Regulatory Requirements Website: <http://www.epa.gov/fedsite/cd/asbestos.html>
 - 9. National Environmental Policy Act (NEPA) requirements for construction activities
 - 10. Endangered Species Act; refer to The US Fish and Wildlife Service Endangered Species Program: <http://endangered.fws.gov/>
 - 11. National Historic Preservation Act
- D. State and Local Environmental Regulatory Requirements: Comply with applicable regulations. The following is for Contractor's information only:
 - 1. New Mexico Environment Department.
 - 2. The Construction Industry Compliance Assistance Center: <http://www.cicacenter.org/index.cfm>
 - 3. The National Environmental Compliance Assistance Clearinghouse: <http://cfpub.epa.gov/clearinghouse/>

1.5 PROTECTION OF ENVIRONMENTAL RESOURCES

- A. Protect environmental resources within the project boundaries and those affected outside the limits of permanent Work during the duration of this contract. Confine construction activities to areas defined by construction limits, the specifications and drawings.
- B. Protection of Land Resources: Prior to construction, identify all land resources to be preserved within the Work area. Do not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, top soil, land forms, wetlands or wetland buffers without prior approval from the COTR. Do not fasten or attach ropes, cables, or guys to trees for anchorage unless specifically authorized, or dictated by special emergency use.
 - 1. Work Area Limits: Prior to any construction, mark/fence/protect the areas that require Work to be performed under this Contract. Mark/fence/protect monuments, works of art, and markers prior to construction. Convey to all personnel the purpose of marking and protecting all marked and protected objects.
 - 2. Protection of Specific Regulated Elements: Wetlands and wetland buffers and other landscape features shown on the Construction Documents to be preserved by marking, fencing, or using any other approved protective techniques.
 - a. Protect trees and shrubs to remain on site to protect from damage per Contract details.
 - b. All damage to existing trees and shrubs shall be immediately repaired by trimming, cleaning, and painting with antiseptic tree paint.
 - c. Do not store building materials or perform construction activities closer to existing trees or shrubs than the farthest extension of their limbs.
 - 3. Reduction of Exposure of Unprotected Erodible Soils: Plan and conduct earthwork to minimize the duration of exposure of unprotected soils. Clear areas only as needed to use to work the area to be developed. Form earthwork to final grade as shown as quickly as possible to minimize potential erosion damage. Immediately protect side slopes and back slopes upon completion of rough grading or clearing with appropriate material as defined in the Erosion and Sediment Control Plan.
 - 4. Temporary Protection of Disturbed Areas: Construct diversion ditches, benches, check dams and berms to retard and divert runoff from the construction site to protected drainage areas as intended under paragraph 208 of the Clean Water Act.
 - a. Sediment Basins: Trap sediment from construction areas in temporary or permanent sediment basins that accommodate the runoff of a local 2 year storm. After each storm, pump the basins dry and remove the accumulated sediment. Control overflow/drainage with paved weirs or by vertical overflow pipes, draining from the surface.
 - b. Reuse or conserve the collected topsoil sediment as directed by the COTR. Topsoil use and requirements are specified in Section 31 20 00, EARTH MOVING.

- c. Institute effluent quality monitoring programs as required by Federal, State, and local environmental agencies.
 - 5. Erosion and Sedimentation Control Devices: Construct or install temporary and permanent erosion and sedimentation control features to avoid violating water quality in accordance with Federal and State regulations. Maintain temporary erosion and sediment control measures such as berms, dikes, drains, sedimentation basins, grassing, and mulching, until permanent drainage and erosion control facilities are completed and operative.
 - 6. Manage and control borrow and spoil areas on Government property to minimize erosion and to prevent soil and/or sediment from entering nearby water courses.
 - 7. Protect adjacent areas from despoilment by temporary excavations and embankments.
 - 8. Handle and dispose of solid wastes in such a manner that will prevent contamination of the environment. Place solid wastes (excluding clearing debris) in containers that are emptied on a regular schedule. Transport all solid waste off Government property and dispose of waste in compliance with Federal, State, and local requirements.
 - 9. Store chemical waste away from the Work areas in corrosion resistant containers and dispose of waste in accordance with Federal, State, and local regulations.
 - 10. Handle discarded materials other than those included in the solid waste category as directed by the COTR.
- C. Protection of Water Resources: Keep construction activities under surveillance, management, and control to avoid pollution of surface and ground waters and sewer systems. Implement management techniques to control water pollution by the listed construction activities that are included in this contract.
- 1. Washing and Curing Water: Do not allow wastewater directly derived from construction activities to enter water areas. Collect and place wastewater in sediment basins prior to entering retention/detention ponds, allowing the suspended material to settle, the pollutants to separate, or the water to evaporate.
 - 2. Monitor water areas, wetlands and wetland buffers affected by construction.
- D. Protection of Fish and Wildlife Resources: Keep construction activities under surveillance, management, and control to minimize interference with, disturbance of, or damage to fish and wildlife. Prior to beginning construction operations, list protected species that require specific attention along with measures for their protection.
- E. Protection of Air Resources: Keep construction activities under surveillance, management, and control to minimize pollution of air resources. Burning is not permitted on the job site. Keep activities, equipment, processes, and Work operated or performed, in strict accordance with the State of New Mexico Air Pollution Regulation and Federal emission and performance laws and standards. Maintain ambient air quality standards set by the Environmental Protection Agency, for those construction operations and activities specified.

1. Particulates: Control dust particles, aerosols, and gaseous by-products from all construction activities, processing, and preparation of materials at all times, including weekends, holidays, and hours when Work is not in progress.
 2. Particulates Control: Maintain all excavations, stockpiles, haul roads, permanent and temporary access roads, spoil areas, borrow areas, and all other Work areas within or outside the project boundaries free from particulates which would cause a hazard or a nuisance. Sprinklering, chemical treatment of an approved type, light bituminous treatment, or other methods are permitted to control particulates in the Work area as approved in the Environmental Protection Plan.
 3. Hydrocarbons and Carbon Monoxide: Control monoxide emissions from equipment to Federal and State allowable limits.
 4. Odors: Control odors of construction activities and prevent obnoxious odors from occurring.
- F. Noise Control: Minimize noise using every action possible. Perform noise-producing Work in less sensitive hours of the day or week as directed by the COTR. Maintain noise-produced Work at or below the decibel levels and within the time periods specified.
1. Perform construction activities involving repetitive, high-level impact noise only between 7:00 a.m. and 6:00 p.m. unless otherwise permitted by local ordinance or the COTR. Repetitive impact noise on the property shall not exceed the following dB limitations:

Time Duration of Impact Noise	Sound Level in dB
More than 12 minutes in any hour	70
Less than 30 seconds of any hour	85
Less than three minutes of any hour	80
Less than 12 minutes of any hour	75

2. Provide sound-deadening devices on equipment and take noise abatement measures that are necessary to comply with the requirements of this contract, consisting of, but not limited to, the following:
 - a. Maintain maximum permissible construction equipment noise levels at 50 feet (dBA):

EARTHMOVING		MATERIALS HANDLING	
Front Loaders	75	Concrete Mixers	75
Backhoes	75	Concrete Pumps	75
Dozers	75	Cranes	75
Tractors	75	Derricks Impact	75
Scrapers	80	Pile Drivers	95
Graders	75	Jack Hammers	75
Trucks	75	Rock Drills	80

Pavers, Stationary	80	Pneumatic Tools	80
Pumps	75		
Generators	75	Saws	75
Compressors	75	Vibrators	75

- b. Provide soundproof housings or enclosures for noise-producing machinery.
 - c. Use efficient silencers on equipment air intakes.
 - d. Use efficient intake and exhaust mufflers on internal combustion engines that are maintained so equipment performs below noise levels specified.
 - e. Line hoppers and storage bins with sound deadening material.
 - f. Conduct truck loading, unloading, and hauling operations so that noise is kept to a minimum.
3. Measure sound level for noise exposure due to the construction at least once every five successive working days while Work is being performed above 75 dBA noise level. Measure noise exposure at the property line or 50 feet from the noise source, whichever is greater. Measure the sound levels on the A weighted sound level of a General Purpose sound level meter at slow response. To minimize the effect of reflective sound waves at buildings, take measurements at three to six feet in front of any building face. Submit the recorded information to the COTR noting any problems and the alternatives for mitigating actions.
- G. Restoration of Damaged Property: If any direct or indirect damage is done to public or private property resulting from any act, omission, neglect, or misconduct, the Contractor shall restore the damaged property to a condition equal to that existing before the damage at no additional cost to the Government. Repair, rebuild, or restore property as directed or make good such damage in an acceptable manner.
- H. Final Clean-up: On completion of project and after removal of all debris, rubbish, and temporary construction, Contractor shall leave the construction area in a clean condition as approved by the COTR. Cleaning shall include off-Cemetery disposal of all items and materials not required to be salvaged, as well as all debris and rubbish resulting from demolition and new Work operations, clearing, logging and general construction in accordance with State and local regulations and the contract.

END OF SECTION

SECTION 01 74 19

CONSTRUCTION WASTE MANAGEMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The Work of this Section specifies the requirements for the management of non-hazardous demolition waste.
- B. Waste disposal in landfills shall be minimized to the greatest extent possible. Of the inevitable waste that is generated, as much of the waste material as economically feasible shall be salvaged, recycled or reused.
- C. Contractor shall use all reasonable means to divert construction and demolition waste from landfills and incinerators, and facilitate their salvage and recycle not limited to the following:
 - 1. Waste Management Plan development and implementation.
 - 2. Techniques to minimize waste generation.
 - 3. Sorting and separating of waste materials.
 - 4. Salvage of existing materials and items for reuse or resale.
 - 5. Recycling of materials that cannot be reused or sold.
- D. At a minimum the following waste categories shall be diverted from landfills:
 - 1. Soil.
 - 2. Inerts (e.g., concrete, masonry and asphalt).
 - 3. Clean dimensional wood and palette wood.
 - 4. Green waste (biodegradable landscaping materials).
 - 5. Engineered wood products (plywood, particle board and I-joists, etc).
 - 6. Metal products (e.g., steel, wire, beverage containers, etc).
 - 7. Cardboard, paper and packaging.
 - 8. Bitumen roofing materials.
 - 9. Plastics (e.g., ABS, PVC).
 - 10. Paint.

1.2 RELATED WORK

- A. Section 02 41 10, DEMOLITION.
- B. Section 01 00 00, GENERAL REQUIREMENTS.

1.3 QUALITY ASSURANCE

- A. Contractor shall practice efficient waste management when sizing, cutting and installing construction products. Processes shall be employed to ensure the generation of as little waste as possible. Construction Demolition waste includes products of the following:
 - 1. Excess or unusable construction materials.
 - 2. Packaging used for construction products.

3. Poor planning and/or layout.
 4. Construction error.
 5. Over ordering.
 6. Weather damage.
 7. Contamination.
 8. Mishandling.
 9. Breakage.
- B. Establish and maintain the management of non-hazardous building construction and demolition waste set forth herein. Conduct a site assessment to estimate the types of materials that will be generated by demolition and construction.
- C. Contractor shall develop and implement procedures to reuse and recycle new materials to maximum extent practical.
- D. Contractor shall be responsible for implementation of any special programs involving rebates or similar incentives related to recycling. Any revenues or savings obtained from salvage or recycling shall accrue to the Contractor.
- E. Contractor shall provide all demolition, removal and legal disposal of materials. Contractor shall ensure that facilities used for recycling, reuse and disposal shall be permitted for the intended use to the extent required by local, State, and/or Federal regulations. The Whole Building Design Guide website <http://www.wbdg.org> provides a Construction Waste Management Database that contains information on companies that haul, collect, and process recyclable debris from construction projects.
- F. Contractor shall assign a specific area to facilitate separation of materials for reuse, salvage, recycling, and return. Such areas are to be kept neat and clean and clearly marked in order to avoid contamination or mixing of materials.
- G. Contractor shall provide on-site instructions and supervision of separation, handling, salvaging, recycling, reuse and return methods to be used by all parties during waste generating stages.
- H. Record on daily reports any problems in complying with laws, regulations and ordinances with corrective action taken.

1.4 TERMINOLOGY

- A. Class III Landfill: A landfill that accepts non-hazardous resources such as household, commercial and industrial waste resulting from construction, remodeling, repair and demolition operations.
- B. Clean: Untreated and unpainted; uncontaminated with adhesives, oils, solvents, mastics and like products.
- C. Construction and Demolition Waste: Includes all non-hazardous resources resulting from construction, remodeling, alterations, repair and demolition operations.

- D. Dismantle: The process of parting out a building in such a way as to preserve the usefulness of its materials and components.
- E. Disposal: Acceptance of solid wastes at a legally operating facility for the purpose of land filling (includes Class III landfills and inert fills).
- F. Inert Backfill Site: A location, other than inert fill or other disposal facility, to which inert materials are taken for the purpose of filling an excavation, shoring or other soil engineering operation.
- G. Inert Fill: A facility that can legally accept inert waste, such as asphalt and concrete exclusively for the purpose of disposal.
- H. Inert Solids/Inert Waste: Non-liquid solid resources including, but not limited to, soil and concrete that does not contain hazardous waste or soluble pollutants at concentrations in excess of water-quality objectives established by a regional water board, and does not contain significant quantities of decomposable solid resources.
- I. Mixed Debris: Loads that include commingled recyclable and non-recyclable materials generated at the construction site.
- J. Mixed Debris Recycling Facility: A solid resource processing facility that accepts loads of mixed construction and demolition debris for the purpose of recovering re-usable and recyclable materials and disposing non-recyclable materials.
- K. Permitted Waste Hauler: A company that holds a valid permit to collect and transport solid wastes from individuals or businesses for the purpose of recycling or disposal.
- L. Recycling: The process of sorting, cleansing, treating, and reconstituting materials for the purpose of using the altered form in the manufacture of a new product. Recycling does not include burning, incinerating or thermally destroying solid waste.
 - 1. On-site Recycling – Materials that are sorted and processed on site for use in an altered state in the Work, i.e. concrete crushed for use as a sub-base in paving.
 - 2. Off-site Recycling – Materials hauled to a location and used in an altered form in the manufacture of new products.
- M. Recycling Facility: An operation that can legally accept materials for the purpose of processing the materials into an altered form for the manufacture of new products. Depending on the types of materials accepted and operating procedures, a recycling facility may or may not be required to have a solid waste facilities permit or be regulated by the local enforcement agency.
- N. Reuse: Materials that are recovered for use in the same form, on-site or off-site.
- O. Return: To give back reusable items or unused products to vendors for credit.

- P. Source-Separated Materials: Materials that are sorted by type at the site for the purpose of reuse and recycling.
- Q. Solid Waste: Materials that have been designated as non-recyclable and are discarded for the purposes of disposal.
- R. Transfer Station: A facility that can legally accept solid waste for the purpose of temporarily storing the materials for re-loading onto other trucks and transporting them to a landfill for disposal, or recovering some materials for re-use or recycling.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 COLLECTION

- A. Provide all necessary containers, bins and storage areas to facilitate effective waste management.
- B. Clearly identify containers, bins and storage areas so that recyclable materials are separated from trash and can be transported to respective recycling facility for processing.
- C. Hazardous wastes shall be separated, stored, disposed of according to local, State, and/or Federal regulations.

3.2 DISPOSAL

- A. Contractor shall be responsible for transporting and disposing of materials that cannot be delivered to a source-separated or mixed materials recycling facility to a transfer station or disposal facility that can accept the materials in accordance with State and Federal regulations.
- B. Construction or demolition materials with no practical reuse or that cannot be salvaged or recycled shall be disposed of at a landfill or incinerator.

END OF SECTION

SECTION 02 41 10

DEMOLITION AND SITE CLEARING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The Work of this Section specifies all site preparation Work, demolition and removal of utilities and other structures and debris.

1.2 RELATED WORK

- A. Safety Requirements: GENERAL CONDITIONS Article, ACCIDENT PREVENTION.
- B. Disconnecting utility services prior to demolition: Section 01 00 00, GENERAL REQUIREMENTS.
- C. Reserved items that are to remain the property of the Government: Section 01 00 00, GENERAL REQUIREMENTS.
- D. Environmental Protection: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.
- E. Waste Management: Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT

1.3 PROTECTION

- A. Perform demolition in such manner as to eliminate hazards to persons and property; to minimize interference with use of adjacent areas, utilities and structures or interruption of use of such utilities; and to provide free passage to and from such adjacent areas of structures. Comply with requirements of GENERAL CONDITIONS Article, ACCIDENT PREVENTION.
- B. Provide safeguards, including warning signs, barricades, temporary fences, warning lights, and other similar items that are required for protection of all personnel during demolition and removal operations. Comply with requirements of Section 01 00 00, GENERAL REQUIREMENTS, Article 1.10 PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES AND IMPROVEMENTS.
- C. Maintain fences, barricades, lights, and other similar items around exposed excavations until such excavations have been completely filled.
- D. Prevent spread of flying particles and dust. Sprinkle rubbish and debris with water to keep dust to a minimum. Do not use water if it results in hazardous or objectionable condition such as, but not limited to ice, flooding, or pollution. Vacuum and dust the Work area daily.

- E. In addition to previously listed fire and safety rules to be observed in performance of Work, include following:
 - 1. Wherever a cutting torch or other equipment that might cause a fire is used, provide and maintain fire extinguishers nearby ready for immediate use. Instruct all possible users in use of fire extinguishers.
 - 2. Keep hydrants clear and accessible at all times. Prohibit debris from accumulating within a radius of 15 feet of fire hydrants.
- F. Before beginning any demolition Work, the Contractor shall survey the site and examine the drawings and specifications to determine the extent of the Work. The Contractor shall take necessary precautions to avoid damages to existing items to remain in place, to be reused, or to remain the property of the Cemetery; any damaged items shall be repaired or replaced as approved by the COTR. The Contractor shall coordinate the Work of this Section with all other Work and shall construct and maintain shoring, bracing, and supports as required. Repairs, reinforcement, or replacement must have COTR's approval.
- G. The Work shall comply with the requirements of Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.
- H. The Work shall comply with the requirements of Section 01 00 00, GENERAL REQUIREMENTS, Article 1.24 PROJECT HEALTH AND SAFETY.

1.4 UTILITY SERVICES

- A. Demolish and remove outside utility service lines shown to be removed. Cap ends of utility services lines at end of removals.
- B. Remove abandoned outside utility lines that would interfere with installation of new utility lines and new construction.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SITE CLEARING

- A. General: Remove trees, shrubs, grass, and other vegetation, pavements, improvements, or obstructions, as required, to permit installation of new construction. Remove similar items elsewhere on site or premises as specifically indicated. Removal includes digging out and off-site disposal of stumps and roots.
 - 1. Cut minor roots (less than 1 inch and outside of drip line of the tree) and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
- B. Erosion Control: Contractor shall provide erosion control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways. Contractor shall install

perimeter controls and inlet protection as shown prior to any soil disturbance activities.

- C. Topsoil - On-site: Topsoil is defined as friable clay loam surface soil found in a depth of not less than 6 inches. Satisfactory topsoil is reasonably free and/or screened of subsoil, clay lumps, stones, and other objects over 1 inch in diameter, and without weeds, roots, and other objectionable material.
 - 1. Strip topsoil to whatever depths encountered in a manner to prevent intermingling with underlying subsoil or other objectionable material. Remove heavy growths of grass from areas before stripping.
 - a. Where existing trees are indicated to remain, leave existing topsoil in place within drip lines to prevent damage to root system.
 - 2. Stockpile topsoil in storage piles in areas indicated or directed. Construct storage piles to provide free drainage of surface water. Cover storage piles to prevent wind erosion. Refer to Division 32 Section 32 90 00 PLANTING for soil amendments required prior to spreading topsoil.
 - a. Stockpile shall be contained with erosion and sediment controls (silt fence, fiber roll) and stabilized if undisturbed.
 - 3. Dispose of unsuitable or excess topsoil as specified for disposal of waste material only after approval of the COTR.
- D. Clearing and Grubbing: Clear site of trees, shrubs, and other vegetation, except for those indicated to be left standing.
 - 1. Completely remove stumps, roots, and other debris protruding through ground surface. Grind tree stumps and roots to a minimum of 18 inches below existing ground or finished surface, whichever is lower.
 - 2. Use only hand methods for grubbing inside drip line of trees indicated to remain.
 - 3. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.
 - a. Place fill material in horizontal layers not exceeding 6 inches loose depth, and thoroughly compact each layer to a density equal to adjacent original ground.
- E. Removal of Improvements: Remove existing above-grade and below-grade improvements, including gravel base materials, as indicated and as necessary to facilitate new construction.
- F. Abandonment or removal of certain underground pipe or conduits may be indicated on electrical Construction Documents and is included under Work of related Division 26 and 33 Sections. Removing abandoned underground piping and conduits interfering with construction is included under this Section, except as indicated to be abandoned in-place.
- G. Continue maintenance of erosion controls until the Work is completed and the threat of erosion is gone by either ground surface stabilizer or lawn "grow-in" is at 85% complete. Temporary erosion control devices shall not be removed until the area is certified as being stabilized by the COTR.

3.2 DEMOLITION

- A. Completely demolish and remove utilities, including all appurtenances related or connected thereto, as noted below:
 - 1. As required for completion of Work, installation of new utility service lines, and as shown on the Construction Documents.
 - 2. To full depth.
 - 3. Record on As-Built Drawings any remaining lines which have been abandoned in place.
- B. Remove and legally dispose of all materials and debris (including brick, concrete, stone, metals and similar materials), other than earth or items to remain as part of project Work. Materials removed shall become property of Contractor and shall be disposed of in compliance with applicable Federal, State or local permits, rules and/or regulations. All materials indicated to be removed shall be included as part of the lump sum compensation for the Work of this Section.
 - 1. Materials that cannot be removed daily shall be stored in areas specified by the COTR.
 - 2. Materials that are discovered to be hazardous shall be handled as unforeseen. The removal of hazardous material shall be referred to Hazardous Materials specifications.
 - 3. Burning is not permitted on the property.
 - 4. Contractor shall pay for all dumping charges or permits required to dispose of materials.
- C. Remove existing utilities as indicated or uncovered by Work and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the COTR. When utility lines are encountered that are not indicated on the Construction Documents, the COTR shall be notified prior to further Work in that area.

3.3 CLEAN-UP

- A. On completion of Work of this Section and after removal of all debris, leave site in clean condition satisfactory to COTR. Clean-up shall include off the Cemetery Property disposal of all items and materials not required to remain property of the Government as well as all debris and rubbish resulting from demolition operations.

END OF SECTION

SECTION 03 21 00

REINFORCING STEEL

PART 1 - GENERAL

1.1 SCOPE

- A. Unless noted otherwise, furnish and install reinforcing for all concrete, including dowels, chairs, spacers, bolsters, etc., necessary for supporting and fastening reinforcement in place as shown on the Drawings and specified herein.

1.2 RELATED WORK (See also Table of Contents)

- A. Concrete Formwork: Section 03 30 00.
- B. Cast-In-Place Concrete: Section 03 30 00.
- C. Concrete Unit Masonry: Section 04 20 00.

1.3 QUALITY ASSURANCE

- A. General:
 - 1. Acceptable Manufacturers: Regularly engaged in the manufacture of steel bar and welded wire fabric reinforcing.
 - 2. Installer Qualifications: Installation shall be done only by an installation firm normally engaged in this business. All work shall be performed by qualified mechanics working under an experienced supervisor.
 - 3. Welding Qualifications: Welding procedures, welding operators and welders shall be qualified in accordance with AWS D1.4 - "Structural Welding Code Reinforcing Steel".
 - a. Welders whose work fails to pass inspection shall be re-qualified before performing further welding.
 - 4. Reinforcement Work shall conform to ACI 301 and IBC Section 1907, as minimum standards.
 - 5. Allowable Tolerances:
 - a. Fabrication:
 - 1) Sheared length: 1 inch.
 - 2) Depth of truss bars: Plus 0, minus ½-inch.
 - 3) Ties: Plus or minus ½-inch.
 - 4) All other bends: Plus or minus 1 inch.
 - b. Placement:
 - 1) Concrete cover to form surfaces: Plus or minus ¼-inch.
 - 2) Minimum spacing between bars: Plus or minus ¼-inch.
 - 3) Crosswise of members: Spaced evenly within 2 inches of stated separation.
 - 4) Lengthwise of members: Plus or minus 2 inches.
 - c. Maximum bar movement to avoid interference with other reinforcing steel, conduits, or embedded items: 2 bar diameters.

- B. Standards and References: (Latest Edition unless otherwise noted):
1. American Concrete Institute (ACI).
ACI 301.....Specifications for Structural Concrete for Buildings
ACI 315.....Details and Detailing of Concrete Reinforcing
ACI318.....Building Code Requirements for Reinforced Concrete
 2. American Society for Testing and Materials (ASTM).
ASTM A82Cold Drawn Wire for Concrete Reinforcement
ASTM A185Welded Steel Wire Fabric for Concrete Reinforcement
ASTM A615Deformed and Plain Billet-Steel Bars for Concrete
Reinforcement
ASTM A706Low Alloy Steel Deformed Bars for Concrete
Reinforcement
 3. Concrete Reinforcing Steel Institute (CRSI) - Manual of Standard Practice
 4. 2009 International Building Code (IBC)
- C. Submittals: (Submit under provisions of Section 01 33 23)
1. Shop Drawings: Prepare in accordance ACI 315. Indicate bending diagrams, assembly diagrams, splicing and laps of bars and shapes, dimensions and details of bar reinforcing and assemblies. Correctness of all reinforcing requirements and work is the responsibility of Contractor. Identify such shop drawings with reference thereon to sheet and detail numbers from Contract Drawings.
 - a. Do not use scaled dimensions from Contract Drawings in determining the lengths of reinforcing bars.
 - b. No reinforcing steel shall be fabricated without approved shop drawings.
 - c. Any deviations from the contract documents must be clearly indicated as a deviation on the shop drawings.
 - d. Areas of high congestion, including member joints and embed locations shall be fully detailed to verify clearances and assembly parameters and coordination with other trades.
 2. Certified mill test reports of supplied reinforcing indicating chemical and physical analysis. Tensile and bend tests shall be performed by the mill in accordance with ASTM A615.
 3. Product Data:
 - a. Manufacturer's specifications and installation instructions for splice devices.
 - b. Bar Supports.
 4. Certificates of Compliance with specified standards:
 - a. Reinforcing bars.
 - b. Welded wire fabric.
 - c. Welding electrodes.
- D. Tests and Inspections:
1. A testing program is required prior to start of construction. Testing program to be done in compliance with the 2009 IBC requirements and in collaboration with Testing Laboratory, Design team, Contractor, COTR. Requirements below are minimum requirements; additional requirements may be required in final testing program.

2. All reinforcing steel whose properties are not identifiable by mill test reports shall be tested in accordance with ASTM A615. One Series of tests for each missing report to be borne by the Contractor.
3. When inspections are indicated for reinforcement placement on the Structural drawings, a special inspector shall be employed to inspect reinforcing placement per IBC Section 1704
4. When tests are indicated for reinforcing steel on the structural drawings, the reinforcing steel used shall be tested in accordance with ASTM A615. One tensile and one bend test for each 2-1/2 tons of steel or fraction thereof, shall be made.
5. Inspect shop and field welding in accordance with AWS D1.4, including checking materials, equipment, procedure and welder qualification as well as the welds. Inspector will use non-destructive testing or any other aid to visual inspection that he deems necessary to assure himself of the adequacy of the weld.
6. Tests and inspection shall be performed by testing agency; when needed to justify rejected work, in which case the cost of retests and reinspection shall be borne by the Contractor.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver reinforcement to project site in bundles marked with metal tags indicating bar size and length.
- B. Handle and store materials to prevent contamination.
 1. Store reinforcement in a manner that will prevent excessive rusting or coating with grease, oil, dirt, and other objectionable materials. Storage shall be in separate piles or racks so as to avoid confusion or loss of identification after bundles are broken.
- C. Deliver and store welding electrodes in accordance with AWS D12.1.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Reinforcement Bars: ASTM A615, Grade 60 for all bars.
 1. Bar reinforcement to be welded shall meet chemical requirements of ASTM A706.
 2. Longitudinal reinforcement in columns and beams of special moment-resisting frames shall meet the chemical requirements of ASTM A706.
- B. Stirrups and Ties: ASTM A615, Grade 60 for all bars.
- C. Steel Dowels: Same grade as bars to which dowels are connected.
- D. Welded wire Fabric: ASTM A185.
- E. Tie Wires: FS-QQ-W-461, annealed steel, black, 16 gauge minimum.

- F. Welding Electrodes: AWS D1.4, low hydrogen, E70XX series.
- G. Bar Supports:
 - 1. Typical, unless noted otherwise; CRSI Class 2 wire supports.
 - a. Do not use wood, brick or other objectionable materials.
 - b. Do not use galvanized supports.
 - 2. Supports placed against ground: Pre-cast concrete blocks not less than 4 inches square with embedded wire.
- H. Mechanical Couplers: Comply with ACI 318 section 12.14.3.

PART 3 - EXECUTION

3.1 FABRICATION

- A. Shop fabricate reinforcement to meet requirements of Drawings.
- B. Fabricate reinforcement in accordance with the requirements of ACI 315 where specific details are not shown or where Drawings and Specifications are not more demanding.
- C. Steel reinforcement shall not be bent or straightened in a manner that will injure the material. Bars with kinks or bends not shown on the Drawings shall not be used. Heating of bars for bending will not be permitted.
- D. Reinforcing shall not be field bent or straightened without structural engineer's review.
- E. Provide offsets in rebar (1:6 maximum) where required to maintain clearances.

3.2 CONDITION OF SURFACES

- A. Examine surfaces and conditions receiving or affecting the work. Do not proceed until unsuitable conditions have been corrected.

3.3 GENERAL

- A. Concrete shown without reinforcing shall be reinforced as similar parts shown with reinforcing except where concrete is specifically noted to be unreinforced.

3.4 PLACEMENT

- A. All reinforcement shall be accurately set in place, lapped, spliced, spaced rigidly and securely held in place and tied with specified wire at all splices and crossing points. All wire tie ends shall point away from the form. Carefully locate all dowel steel to align with wall and column steel.
 - 1. Bars shall be in long lengths with laps and splices as shown. Offset laps in adjacent bars. Place steel with clearances and cover as shown. Bar laps shall be as indicated on the Drawings. Tie all laps and intersections with the specified wire.

2. Maintain clear space between parallel bars not less than 1-1/2 times nominal diameter, but in no case shall clear space be less than 1-1/2 times maximum size concrete aggregate.
 3. Reinforcing dowels for slabs shall be placed as detailed. Sleeves may be used if reviewed by the COTR before installation. Install dowel through all construction and expansion joints for all slabs on grade.
- B. Bar Supports: Support and securely fasten bars with chairs, spacers and ties to prevent displacement by construction loads or placement of concrete beyond the tolerances specified. Conform to CRSI as a minimum standard.
- C. Steel Adjustment:
1. Move within allowable tolerances to avoid interference with other reinforcing steel, conduits, or embedded items.
 2. Do not move bars beyond allowable without concurrence of COTR.
 3. Do not heat, bend, or cut bars without concurrence of COTR.
 4. Reinforcement shall not be bent after being embedded in hardened concrete.
- D. Splices:
1. Splice reinforcing as shown.
 2. Lap Splices: Tie securely with wire to prevent displacement of splices during placement of concrete.
 3. Splice Devices: Install in accordance with manufacturer's written instructions. Obtain COTR's review before using.
 4. Do not splice bars except at locations shown without concurrence of COTR.
 - a. Where splices in addition to those indicated are required, indicate location on shop drawings clearly and highlight "for COTR's approval".
- E. Welding:
1. Welding is not permitted unless specifically detailed on Drawings or approved by COTR.
 2. Employ shielding metal-arc method and meet requirements of AWS D1.4.
 3. Welding is not permitted on bars where the carbon equivalent is unknown or is determined to exceed 0.55.
 4. Welding shall not be done within two bar diameters of any bent portion of a bar which has been bent cold.
 5. Welding of crossing bars is not permitted.
- F. Welded Wire Fabric: Install in long lengths, lapping 24 inches at end splices and one mesh at side splices. Offset laps in adjacent widths. Place fabric in approximately the middle of the slab thickness unless shown otherwise on the Drawings by dimension. Wire tie lap joints at 12-inch centers. Use concrete blocks to support mesh in proper position.
- G. Reinforcement shall be free of mud, oil or other materials that may reduce bond at the time concrete is placed. Reinforcement with tightly adhered rust or mill scale will be accepted without cleaning provided that rusting has not reduced dimensions and weights below applicable standards. Remove loose rust.

- H. Protection against rust:
 - 1. Where there is danger of rust staining adjacent surfaces, wrap reinforcement with impervious tape or otherwise prevent rust staining.
 - 2. Remove protective materials and clean reinforcement as required before proceeding with concrete placement.
- I. Drawing Notes: Refer to notes on Drawings for additional reinforcement requirements.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SCOPE

- A. The Work of this Section includes furnish, place and finish cast in place concrete and related Work as indicated on the Construction Documents and specified here.
 - 1. Provide and erect formwork as required.
 - 2. Install miscellaneous metal and other items furnished by other trades to be installed in concrete work.
 - 3. Provide facilities for job curing of test cylinders and transporting to Testing Laboratory.

1.2 RELATED WORK

- A. Reinforcing Steel: Section 03 21 00.
- B. Concrete Paving: Section 32 05 23.
- C. Mortar: 04 05 13.
- D. Grout: 04 05 16.

1.3 QUALITY ASSURANCE

- A. Standards and References: (Latest Edition unless otherwise noted)
 - 1. 2009 International Building Code (IBC).
 - 2. AMERICAN CONCRETE INSTITUTE (ACI)
 - ACI 117.....Standard Tolerances for Concrete Construction and Materials
 - ACI 211.1.....Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
 - ACI 211.2.....Standard Practice for Selecting Proportions for Structural Lightweight Concrete
 - ACI 301.....Structural Concrete for Buildings
 - ACI 302.....Guide for Concrete Floor and Slab Construction
 - ACI 305R.....Hot Weather Concreting
 - ACI 318.....Building Code Requirements for Reinforced Concrete
 - ACI 360.....Design of Slabs-On-Ground
 - 3. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
 - ASTM C31Making and Curing Concrete Test Specimens in the Field
 - ASTM C33Concrete Aggregates
 - ASTM C39Compressive Strength of Cylindrical Concrete Specimens
 - ASTM C42Obtaining and Testing Drilled Cores and Sawed Beams of Concrete

ASTM C94 Ready-Mixed Concrete
ASTM C143 Slump of Hydraulic Cement Concrete
ASTM C150 Portland Cement
ASTM C172 Sampling Freshly Mixed Concrete by the Volumetric Method
ASTM C192 Making and Curing Concrete Test Specimens in the Laboratory
ASTM C260 Air-Entraining Admixtures for Concrete
ASTM C330 Lightweight Aggregates for Structural Concrete
ASTM C494 Chemical Admixtures for Concrete
ASTM C618 Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
ASTM C157 Length Change of Hardened Hydraulic-Cement Mortar and Concrete

- B. Submittals: (Submit under provisions of Section 01 33 23)
1. Concrete mix designs. See "Mix Design" below. Include results of test data used to establish proportions.
 2. Certificates of Compliance from Manufacturer
 - a. Cement
 - b. Aggregates
 - c. Admixtures.
 3. Transit-mix delivery slips:
 - a. Keep record at the job site showing time and place of each pour of concrete, together with transit-mix delivery slips certifying contents of the pour.
 - b. Make the record available to the COTR for his inspection upon request.
 - c. Upon completion of this portion of the Work, deliver the record and the delivery slips to the COTR.
 4. Shop Drawings: Reinforcing steel: Complete shop drawings.
 5. Manufacturer's Certificates: Air entraining admixture, chemical admixtures, curing compounds.
 6. All products listed herein and used on the Project.
- C. Tests and Inspections:
1. A testing program is required prior to start of construction. Testing program to be done in Compliance with the 2009 IBC requirements and in collaboration with Testing Laboratory, Design team, Contractor, and COTR. Requirements below are minimum requirements; additional requirements may be required in final testing program.
 2. If concrete tests are indicated as required on the Structural Construction Documents, the following tests shall be made by a recognized testing laboratory selected by the COTR and approved by the building official. All tests shall be in accordance with the previously mentioned standards. A complete record of all tests and inspections shall be kept per IBC Section 1903.1.3.
 - a. Compressive Strength: Make and cure in accordance with ASTM C-31. Test in accordance with ASTM C-39 and IBC Section 1905.6.

- 1) A record shall be made of time and of locations of concrete from which samples were taken.
- 2) Three identical cylinders shall be taken from each pour of 100 cubic yards or 5000 square feet or part thereof, being placed each day per IBC Section 1905.6.1. One cylinder shall be tested at age 7 days and two at age 28 days unless otherwise specified.
- b. Drying Shrinkage: (applies to lightweight concrete only unless noted otherwise)
 - 1) A record shall be made of time cylinders and of locations of concrete from which samples were taken.
 - 2) Three identical 4" x 4" x 11" specimens shall be made from same concrete as used in structure. Percent of shrinkage shall be reported at 21 days after 7 day moist curing period. Average results of 3 specimens shall be used as the accepted value. The value for laboratory cast specimens shall not exceed .075%. If field test specimens are used in lieu of laboratory specimens, a tolerance of +33% may be used.
 - 3) Test specimens in accordance with ASTM C157.
- c. Concrete consistency (slump) shall be tested in accordance with ASTM C143.
3. If concrete inspections are indicated as required on the Structural Construction Documents, provide full time inspection per IBC Section 170 during the taking of test specimens and during the placing of all concrete required to possess a compressive strength greater than 2500 psi at 28 days.
4. See Section 03 21 00 for reinforcing steel tests and inspections.

PART 2 - PRODUCTS

2.1 MATERIAL

- A. Portland Cement: ASTM C 150, Type I or Type II. One brand of cement shall be used throughout to maintain uniform color for all exposed concrete.
- B. Concrete Aggregate: Fine and coarse Aggregates shall be regarded as separate ingredients. Each size of coarse Aggregate, as well as combination of sizes when two or more are used, shall conform to grading requirements of appropriate ASTM Standards.
 1. Concrete Aggregates for Standard Weight Concrete: ASTM C 33.
 2. Aggregate shall be crushed granite or Perkins type. Max size is 1 1/2". See sub-paragraphs in 2.2 CONCRETE and Construction Documents for aggregate requirements for each concrete mix type.
 3. Concrete Aggregates for Lightweight Concrete: ASTM C330 to produce concrete weighing no more than 115 pcf at 28 days. Aggregate shall be vacuum saturated expanded shale as produced through the rotary kiln method.

- C. Water: Clean and free from injurious amounts of oil, acids, alkali, organic matter and other deleterious substances; suitable for domestic consumption per ACI 318.
- D. Admixtures shall be subject to prior approval by the COTR, in accordance with ACI 318, Calcium Chloride is not permitted.
 - 1. Water Reducing
 - a. ASTM C494 Type A - for use in cool weather.
 - b. ASTM C494 Type D - for use in hot weather.
 - 2. Air Entraining
 - a. Conform to ASTM C 260
 - 3. Fly Ash
 - a. Conform to ASTM C 618
 - 4. Mid-Range Water-Reducers
 - a. Master Builders "Polyheed" or approved equal.
 - 5. Water Resisting
 - a. Moxie 1800 Super Admix by Moxie International or approved equal formulated to resist moisture vapor migration and alkali efflorescence.
 - 6. Fly Ash Pozzolan
 - a. Conforming to ASTM A-618 Class F.
- E. Slab on Grade Vapor Retarder
 - 1. Vapor Retarder must have the following qualities:
 - a. 15 mil thickness minimum
 - b. WVTR less than 0.008 as tested by ASTM E 96
 - c. ASTM E 1745 Class A (Plastics)
 - 2. Vapor Retarder Products
 - a. Stego Wrap Vapor Retarder by STEGO INDUSTRIES LLC.
 - b. W.R. Meadows Premoulded Membrane with Plasmatic Core.
 - c. Zero-Perm by Alumiseal.
 - 3. Vapor Retarder Tape
 - a. Water Vapor Transmission Rate :ASTM E 96, 0.3 perms or lower
 - b. Minimum 8-mils thick
 - c. Minimum 4 inches wide
- F. Sand: Clean, dry, well graded.
- G. Abrasive aggregate for non slip finish: Fused aluminum oxide grits, graded 12/30. Use factory graded rustproof and non glazing material that is unaffected by freezing, moisture and cleaning materials.
 - 1. Products offered by manufacturers to comply with the above requirements include: A H Alox; Anti Hydro Waterproofing Co., Toxgrip; Toch Div. Carboline, or approved equal.
- H. Expansion Joint Filler:
 - 1. Joint fill shall be a preformed non-extruded resilient filler, saturated with bituminous materials and conforming to ASTM D 1751. Products shall be equivalent to Burke "Fiber Expansion Joint", W.R. Meadows "Fibrated Expansion Joint Filler", or approved equal.

- I. Bonding Agent: Sonneborn "Sonobond"; the Euclid Chemical Company "Euco-Weld"; Larsen Products Corp., "Weld-Crete" or approved equivalent.
- J. Concrete Sealer: Cure and Seal, as manufactured by the Euclid Chemical Company "Aqua-Cure VOX", Sonneborn "Kure-N-Seal WB", Burke "Spartan-Cote", W.R. Meadows "Intex" or approved equal conforming to ASTM C-309, Type I, Class B requirements, and conforming to State of California Air Resources Board VOC Regulations.
- K. Concrete Hardener/Sealer: Clear, water soluble, sprayable in-organic silicate based hardener/sealer or acrylic co-polymer resin. Products shall be equal to Euclid Chemical Company "Eucosil", Burke "Spartan-Cote", Sonneborn "Sonosil", W.R. Meadows "Pena-Lith", or approved equal and must conform to State of California Air Resources Board VOC Regulations.
- L. Concrete Cure: Water based curing compound conforming to ASTM C-309, Type 1, Class A and B, and AASHTO Specification M-148; Type 1, Class A and B requirements, and State of Louisiana VOC Regulations. Product shall be equivalent to Euclid Chemical Company "Kurez DR VOX", Burke "No. 1127" or "Aqua-Resin Cure", W.R. Meadows "1100 Clear", or approved equal. Because of the wide variety of paints and adhesives for carpeting and resilient tile in use, contact the manufacturer of the flooring system for application approval of all curing compounds.
- M. Concrete Dry Shake Floor Hardener: Free flowing powder applied prior to smooth steel trowel finish in accordance with manufacturer's requirements. Products shall be equal to Euclid Chemical Company "Surflex" or approved equal
- N. Non-Shrink Grout: See Section 2.2.A.7
- O. Anchor Bolts: All anchor bolts cast in concrete shall be headed bolts with cut threads conforming to ASTM A307 or ASTM A36 or ASTM A572.50 as indicated on drawings.
- P. Expansion Anchors: All expansion bolts installed in concrete shall be KB-TZ expansion bolts as manufactured by Hilti Inc. See Structural Construction Documents for installation requirements and tension testing requirements as applicable. See Construction Documents for special head requirements as needed. Substitution of other brands or anchors shall proceed only after written approval from the Structural Engineer and the COTR has been obtained.

2.2 CONCRETE

- A. Concrete Mixes:
 - 1. Type A Concrete:
 - a. Strength: 3000 lbs. per square inch at 28 days.
 - b. Maximum Aggregate Size: 1-1/2 inch.
 - c. Cement Content: As determined by mix design (ACI 318 Section 5.2).
 - d. 5.0 sacks per yard minimum.
 - e. Maximum Water to Cement Ratio: 0.58

- f. Admixture: Water Reducing.
 - g. Weight: 145 lbs. per cubic foot
 - h. Maximum Fly Ash content as a percentage of total cementitious material: 15%
 - i. Use for unexposed foundation concrete and thrust blocking except as otherwise specified. At Contractor's option, Type B concrete may be used in lieu of Type A.
- 2. Type B Concrete:
 - a. Strength: 3500 lbs. per square inch at 28 days.
 - b. Maximum Aggregate Size: 1 inch.
 - c. Minimum Cement Content: As determined by mix design. (ACI 318 Section 5.2)
 - d. 5.5 sacks per yard minimum.
 - e. Maximum Water to Cement Ratio: 0.45
 - f. Admixture: Water reducing.
 - g. Weight: 145 lbs. per cubic foot
 - h. Use for building slab on grade
 - i. Maximum Fly Ash content as a percentage of total cementitious material: 15%
- 3. Type C Concrete:
 - a. Strength: 4000 lbs. per square inch at 28 days.
 - b. Maximum Aggregate Size: 1 inch.
 - c. Minimum Cement Content: As required by mix design (ACI 318 Section 5.2).
 - d. 6.5 sacks per yard minimum.
 - e. Maximum Water to Cement Ratio: 0.50
 - f. Admixture: Water reducing, Air entraining.
 - g. Weight: 145 lbs. per cubic foot
 - h. Maximum Fly Ash content as a percentage of total cementitious material: 15%
 - i. Use for concrete exterior paving, sidewalks, curb, gutters, columns, beams, walls, elevated slabs, and as otherwise specified
- 4. Grout shall be non shrink, non metallic, flowable Type "713" or "928" by Master Builders.
 - a. Non shrink grout equivalent to US Mix Products Co. "Premium Grout" may be used only where covered by earth, concrete, or masonry.
 - b. Acceptance by Architect required before using.
 - c. Use for grouting and/or drypacking of column base plates, other metal items, and other locations as indicated on the Drawings
- B. Consistency of Concrete: Concrete slump, measured in accordance with ASTM C 143, shall fall within following limits.
 - 1. For General concrete placement: 3 inch plus or minus 1 inch.
 - 2. Mixes employing the specified mid-range water reducer shall provide a measured slump not to exceed 7 inch +1 inch after dosing, 2 inch +1 inch before dosing.
 - 3. Concrete slump shall be taken at point of placement. Use water reducing admixtures as required to provide a workable consistency for pump mixers. Water shall not be added at the jobsite without written review by the COTR.

C. Mix Design:

1. Initial mix design shall be prepared for Type A, Type B, and Type C concrete by recognized testing laboratory (approved by the COTR) in accordance with IBC Section 1905.3 or IBC Section 1905.4. In the event that additional mix designs are required due to depletion of Aggregate sources, Aggregate not conforming to Specifications, or at request of Contractor, these mixes shall be prepared as above.
2. Contractor shall notify the Testing Laboratory and COTR of intent to use concrete pumps to place concrete so that mix designs can be modified accordingly.
3. Fly ash shall not exceed the percentages of the total cementitious material listed in the Concrete Mixes above.
4. Provide 6% air entrainment typical for exterior concrete.
5. COTR's testing laboratory shall review all mix design before submittal.
6. If special mixes are required for slip form or machined place concrete, Contractor is to submit these separately.

D. Mixing:

1. Equipment: All concrete shall be machine mixed. Provide adequate equipment and facilities for accurate measurement and control of materials.
2. Method of Mixing:
 - a. Transit Mixing: Comply with ASTM C 94. Ready mixed concrete shall be used throughout, except as specified below.
 - b. On-Site Mixing: Use only if method of storing material, mixing of material and type of mixing equipment is approved by the COTR. Approval of site mixing does not relieve Contractor of any other requirements of Specifications.
 - c. Mixing shall be in accordance with IBC Section 1905.8.
3. Mixing Time: After mix water has been added, concrete shall be mixed not less than 1-1/2 minutes nor more than 1-1/2 hours. Concrete shall be rejected if not deposited within the time specified.
4. Admixtures:
 - a. Air entraining and chemical admixtures shall be charged into mixer as a solution and shall be dispensed by an automatic dispenser or similar metering device. Powdered admixtures shall be weighed or measured by volume as recommended by manufacturer. Accuracy of measurement of any admixture shall be within plus or minus 1.5%.
 - b. Two or more admixtures may be used in same concrete, provided such admixtures are added separately during batching sequence, and provided further that admixtures used in that combination retain full efficiency and have no deleterious effect on concrete or on properties of each other.
 - c. All admixtures are to be approved by Engineer prior to commencing this Work.
5. Retempering:
 - a. Concrete shall be mixed only in quantities for immediate use. Concrete which has set shall be discarded, not retempered.
 - b. Indiscriminate addition of water to increase slump is prohibited.

- c. When concrete arrives at project with slump below that suitable for placing, water may be added only if neither maximum permissible water-cement ratio nor maximum slump is exceeded. Water shall be incorporated by additional mixing equal to at least half of total mixing time required. Any addition of water above that permitted by limitation of water-cement ratio shall be accompanied by a quantity of cement sufficient to maintain proper water-cement ratio. Such additions shall only be used if approved by COTR. In any event, with or without addition of cement, not more than 2 gallons of water per cubic yard of concrete, over that specified in design mix, shall be added.
- 6. Cold Weather Batching: When temperature is below 40 degrees F or is likely to fall below 40 degrees F during 24 hour period after placing, provide adequate equipment for heating concrete materials. No frozen materials or materials containing ice shall be used. Temperatures of separate materials, including mixing water, when placed in mixer shall not exceed 100 degrees F. When placed in forms concrete shall have a temperature between 50 degrees F and 85 degrees F.
- 7. Hot Weather Batching: Concrete deposited in hot weather shall have a placing temperature below 85 degrees F. If necessary, ingredients shall be cooled to accomplish this.

PART 3 - EXECUTION

3.1 PLACEMENT

- A. Before any concrete is placed, the following items of Work shall have been completed in the area of placing.
 - 1. Forms shall have been erected, adequately braced, cleaned, sealed, lubricated if required, and bulkheaded where placing is to stop.
 - 2. Any wood forms other than plywood shall be thoroughly water soaked before placing any concrete. The wetting of forms shall be started at least 12 hours before concreting.
 - 3. Clean and coat removable metal forms with light form oil before reinforcement is placed. In hot weather cool metal forms by thoroughly wetting with water just before placing concrete.
 - 4. Reinforcing steel shall have been placed, tied and supported.
 - 5. Embedded Work of all trades shall be in place in the forms and adequately tied and braced including weepholes, screens and sleeves.
 - 6. The entire place of deposit shall have been cleaned of wood chips, sawdust, dirt, debris, hardened concrete and other foreign matter. No wooden ties or blocking shall be left in the concrete except where indicated for attachment of other Work.
 - 7. Reinforcing steel, at the time the concrete is placed around it, shall be cleaned of scale, mill scale or other contaminants that will destroy or reduce bond.
 - 8. Concrete surfaces to which fresh concrete is to be bonded shall be brush cleaned to remove all dust and foreign matter and to expose the Aggregate, and then coated with the bonding adhesive herein specified.

9. Prior to placing concrete for any slabs on grade, the moisture content of the subgrade below the slabs shall be adjusted to at least optimum moisture.
 10. No concrete shall be placed until the COTR has observed formwork and reinforcement. Clean forms of all debris and remove standing water. Thoroughly clean reinforcement and all handling equipment for mixing and transporting concrete. Concrete shall not be placed against reinforcing steel that is hot to the touch. Notify COTR 48 hours in advance of concrete pour.
- B. Machine Placed Concrete: Control lines and surfaces shall be carefully checked and prepared to reflect drawings and specifications. Abrupt changes in direction or grade not indicated will require replacement.
- C. Conveying: Handle concrete from mixer to place of final deposit by methods which will prevent separation or loss of ingredients. Deposit concrete in forms as nearly as practicable at its final position in a manner which will insure that required quality is obtained. Chutes shall slope not less than 4 inches and not more than 6 inches per foot of horizontal run.
- D. Depositing: Deposit concrete into forms in horizontal layers not exceeding 24 inches in thickness around building, proceeding along forms at a uniform rate and consolidating into previous pour. In no case shall concrete be poured into an accumulation of water ahead of pour, nor shall concrete be flowed along forms to its final place of deposit. Fresh concrete shall not be permitted to fall from a height greater than 6 feet without use of adjustable length pipes or, in narrow walls, of adjustable flexible hose sleeves. Concrete shall be scheduled so that placing is a continuous operation for the completion of each section between predetermined construction joints. If any concreting operation, once planned, cannot be carried on in a continuous operation, concreting shall stop at temporary bulkheads, located where resulting construction joints will least impair the strength of the structure. Location of construction joints shall be as shown on the Construction Documents or as approved by the COTR. The rate of rise in walls shall not be less than 2 feet per hour.
1. Consolidation: Concrete shall be thoroughly compacted and worked to all points with solid continuous contact to forms and reinforcement to eliminate air pockets and honeycombing. Power vibrators of approved type shall be used immediately following pour. Spading by hand, hammering of forms or other combination of methods will be allowed only where permitted by Engineer. In no case shall vibrators be placed against reinforcing steel or used for extensive shifting of deposited fresh concrete. Provide and maintain standby vibrators, ready for immediate use.
 2. Hot Weather Concreting: Unless otherwise directed by the COTR, perform all Work in accordance with ACI 305 when air temperature rises above 75 degrees F and the following:
 - a. Mixing Water: Keep water temperature as low as necessary to provide for the required concrete temperature at time of placing. Ice may be required to provide for the design temperature.
 - b. Aggregate: Keep Aggregate piles continuously moist by sprinkling with water.

- c. Temperature of Concrete: The temperature of the concrete mix at the time it is being placed in the forms shall not exceed 85 degrees F. The method employed to provide this temperature shall in no way alter or endanger the design mix or the design strength required.
 - d. Dampen subgrade and formwork before placing concrete. Remove all excess water before placing concrete. Keep concrete continuously wet when air temperature exceeds 85 degrees F for a minimum of 48 hours after placing concrete.
 - e. Protection: Minimize evaporation from concrete in place by providing shade and windbreaks. Maintain such protection in place for 14 days minimum.
 - 3. Cold Weather Concreting: Follow recommended ACI 306 procedures when air temperature falls below 40 degrees F., as approved by the COTR. Concrete placed in freezing temperatures shall have a temperature of not less than 50 degrees F. Maintain this temperature for at least 7 days. No chemicals or salts shall be used to prevent freezing and no accelerating agents shall be used without prior approval from the COTR.
- E. Construction Joints: Install as indicated and noted on Construction Documents. Joints not indicated on Construction Documents shall be so located, when approved, as to least impair strength of structure, and shall conform to typical details. Construction joints shall have level tops, vertical sides. Horizontal construction joints shall be thoroughly cleaned and roughened by removing entire surface film and exposing clean Aggregate solidly embedded in mortar matrix. Joints between concrete and masonry shall be considered construction joints. Vertical construction joints need not be roughened. See Construction Documents for doweling and required keys.
- 1. Roughen construction joints by any of following methods:
 - a. By sandblasting joint.
 - b. By thoroughly washing joint, using a high pressure hose, after concrete has taken initial set. Washing shall be done not less than 2 hours nor more than 4 hours after concrete has been poured, depending upon setting time.
 - c. By chipping and wire brushing.
 - 2. All decisions pertaining to adequacy of construction joint surfaces and to compliance with requirements pertaining to construction joints shall rest exclusively with the COTR.
 - 3. Just before starting new pour, horizontal and vertical joint surfaces shall be dampened (but not saturated).
 - 4. Before placing regular concrete mix, horizontal construction joint surfaces shall be covered with a layer of mortar composed of cement and fine Aggregate of same proportions as that used in prescribed mix, but omitting coarse Aggregate.
- F. Control Jointing – Slabs on Grade:
- 1. Joints shall be in locations indicated on Drawings, or as directed by COTR.
 - 2. Joints in interior slabs shall be made by one of following methods:

- a. By use of construction joints laid out in checkerboard pattern; pour and allow alternate slabs to set; fill out balance of checkerboard pattern with second pour.
 - b. By use of dummy groove joints at least 1/4 depth of slab, and at least 1/8 inch wide. These joints may be sawcut as soon as wet concrete can support the weight of the equipment and operator. Delaying sawcutting past this point will make jointing ineffective.
 - 3. Control jointing in exterior paving slabs shall be laid out in a checkerboard pattern; pour as described above, but with joint edges tooled to provide a uniform joint at least 3/8 inch in depth.
 - 4. Slab reinforcing need not be terminated at control joints.
 - 5. Construction and expansion joints shall be counted as control joints.
- G. Expansion Joints:
- 1. Unless otherwise indicated, use 3/8 inch thick expansion joint filler.
 - 2. Joints in interior slabs on grade shall be only in locations indicated.
 - 3. Joints in exterior slabs on grade shall be installed at each side of structures, at curb transitions opposite apron joints, at ends of curb returns, at back of curb when adjacent to sidewalk, and at uniformly spaced intervals not exceeding 20 feet.
 - 4. Edges of concrete at joints shall be edger finished to approximately 3/8 inch radius.
 - 5. Interrupt reinforcing at all expansion joints.
- H. Score markings on exterior slabs on grade shall be located as indicated. Where not indicated, mark slabs into rectangles of not less than 12 square feet nor more than 20 square feet using a scoring tool which will leave edges of score markings rounded.

3.2 CONCRETE SLABS ON GRADE (EXTERIOR):

- A. Exterior concrete slabs on grade shall be poured as required under this Section. Base shall be accurately leveled and compacted prior to placing of concrete.
- B. Control Jointing - Slabs on Grade:
- 1. Joints shall be in locations indicated on Construction Documents, or as directed by COTR.
 - 2. Control jointing in exterior paving slabs shall be poured in a checkerboard pattern with joint edges tooled to provide a uniform joint at least 3/8 inch in depth.
 - a. Slab reinforcing need not be terminated at control joints.
 - b. Construction and expansion joints shall be counted as control joints.
- C. Expansion Joints - Slabs on Grade:
- 1. Unless otherwise indicated, use 3/8 inch thick expansion joint filler.
 - 2. Joints in exterior slabs on grade shall be installed at each side of fixed structures, walls, at curb transitions opposite apron joints, at ends of curb returns, at back of curb when adjacent to sidewalk, and at uniformly spaced intervals not exceeding 20 feet.

3. Edges of concrete at joints shall be edger finished to approximately 3/8 inch radius.
 4. Interrupt reinforcing at all expansion joints.
- D. Score markings on exterior slabs on grade shall be located as indicated. Where not indicated, mark slabs into rectangles of not less than 12 square feet nor more than 20 square feet using a scoring tool which will leave edges of score markings rounded.

3.3 CURING AND PROTECTION

- A. Curing: Exposed surfaces of all concrete used in structure shall be maintained in a moist condition for at least 7 days after placing. The following final curing processes shall normally be considered to accomplish this. Concrete shall be maintained at not less than 50 degrees F nor more than 100 degrees F for a period of 72 hours after being deposited.
1. Initial Curing Process - Flat Work:
 - a. Mist Spraying: As soon as troweling of concrete surfaces is completed, exposed concrete shall be sprayed continuously with a special atomizer spray nozzle, capable of producing a fine mist. Spraying shall be done without any dripping of water from nozzle. Amount of spraying shall be such as to maintain surface of concrete moist without any water accumulating on surface. Maintain spraying for a minimum of 12 hours, or until such time as hereinafter described curing process is applied. Mist spraying will not normally be required when the ambient air temperature is below 90 degrees F.
 2. Final Curing Process - Flatwork: Except as noted, use any of following:
 - a. Water Curing: Concrete shall be kept wet by mechanical sprinklers or by any other approved method which will keep surfaces continuously wet.
 - b. Saturated Burlap Curing: Finished surfaces shall be covered with a minimum of two layers of heavy burlap which shall be kept saturated during the curing period.
 - c. Curing Compounds: Apply a water based curing compound as indicated in Materials. Membrane curing compounds of chlorinated rubber or resin type conforming to ASTM C309 may be used only if specifically approved by COTR. Use of membrane curing compound will not be permitted on surfaces to be painted, or to receive ceramic tile, membrane water-proofing or hardeners and sealers. Membrane curing compound may be used in areas to receive resilient floor tile, provided it is wax-free, compatible with adhesive used and approved by adhesive manufacturer. Agitate curing compounds thoroughly by mechanical means continuously during use and spray or brush uniformly in accordance with manufacturer's recommendations. Apply immediately following final finishing operation. All curing compounds shall conform to State of New Mexico VOC Regulations.
 3. Curing Process - Formed Surfaces: Forms heated by sun shall be kept moist during curing period. If forms are to be removed during curing period, curing as described for flatwork shall be commenced immediately.

- B. Refer to Drawings for areas of concrete slab not to receive curing compounds or hardening compounds. Where concrete floors are to receive heavy duty coatings, waterproof coatings and the like, verify with coating installer the type of finish required for specified coating.
- C. Protection: Contractor shall be responsible for protection of finished concrete against injury by rain, cold, vibration, animal tracks, marking by visitors, vandalism, etc.
- D. Provide additional curing agents or compounds, not necessarily listed herein, but as recommended and or required for use with shake type hardeners or other special coatings and coverings by their manufacturers for a complete and proper installation.

3.4 FINISHES

- A. Formed Surfaces:
 - 1. Rough Form Finish: Surfaces shall be reasonably true to line and plane with no specified requirements for selected facing materials. Tie holes and defects shall be patched and fins exceeding 1/4 inch in height shall be rubbed down with wooden blocks. Fins and other rough spots at surfaces to receive membrane waterproofing shall be completely removed and the surfaces rubbed smooth. Otherwise, surfaces shall be left with the texture imparted by forms.
 - a. Rough finish shall be used for the following areas:
 - 1) 6" below grade and under on unexposed surfaces.
 - 2. Smooth Plywood Form Finish: Finish shall be true to line and plane. Tie holes and defects shall have been patched and ground with surface fins removed. Arrangement of plywood sheets shall be orderly, symmetrical, as large as practical and free of torn grain or worn edges. Surface concrete shall be treated with 1 part muriatic acid, in three parts water solution, followed immediately by a thorough rinsing with clear water. Surfaces which are glazed, have efflorescence, or traces of form oil, curing compounds or parting compounds shall be cleaned or treated to match other formed surfaces, except as otherwise indicated or specified.
 - a. Smooth Plywood Form Finish shall be used for the following areas:
 - 1) All surfaces from 6" below grade and above unless otherwise specified.
 - 2) At Contractor's option, may also be used in lieu of rough form finish.
- B. Flatwork:
 - 1. Unless otherwise indicated or specified, flatwork shall have an integral monolithic finish.
 - 2. Integral Monolithic Finish: Apply as soon as freshly poured concrete slabs will bear weight of workers. Pour slabs full thickness to finish floor elevations indicated. At proper time, tamp surface repeatedly with a wire mesh or grid tamper in a manner to force Aggregate down below surface and to bring sufficient mortar to surface to provide for a smooth coating of

cement mortar over entire surface. Allow surface mortar to partially set, then float with wooden floats and finish with following:

- a. Broom Finish: Steel trowel surface to a smooth dense surface free of lines, tool marks, cat faces and other imperfections. After troweling, and before final set, give surface a broom finish, brushing in direction noted on Construction Documents, or as directed. Broom finish shall be used typically on exterior flatwork except as otherwise indicated or specified and shall be "medium" texture as approved by COTR.

3. Tolerances:

- a. For tolerances not indicated, refer to ACI 117.
- b. Finished surfaces of exterior integral finished flatwork shall not vary more than 1/4 inch from a 10' long straightedge, except at grade changes.

C. Sacked Surfaces: Exposed surfaces that are unacceptable in appearance to the COTR shall be sacked.

1. Prepare concrete surfaces in accordance with the referenced standards. Remove any form release materials by stoning by hand, power grinding or other method approved by the COTR.
2. Prepare concrete surfaces to receive sack finishing with a light sand blasting.
3. For best results, grout application and rubbing should be performed when areas to be treated are shaded and during cool, damp weather. When Work is to be performed in hot and dry weather, a fog spray should be available for continuous use.
4. Prepare grout samples for matching of concrete surfaces for approval by the COTR. These shall be made in the following proportions of gray cement to white cement to sand: 1:1:2, 1:2:3, and 2:1:3, etc. until the correct matching color is obtained on the test areas. Sand should be fine enough to pass the Number 30 sieve. Mixes should be made to a good workable consistency in a clean container and the mix with the best color chosen, or modified if needed.
5. Provide sufficient quantities of sand and cement from the same source for the complete Work at the job site.
6. Mixing and Application:
 - a. Mixing of grout on the job should be timed for it to be used up within 1 to 1-1/2 hours.
 - b. Let the grout stand 20 to 30 minutes after mixing, and then remixed before applying.
 - c. Soak the concrete surface thoroughly with water at least 15 minutes before applying grout and again just before application so that the surface is adequately wet during the operation.
 - d. Apply grout with plasterer's trowel or sponge rubber float in sweeping strokes from the bottom up. Brush or spray gun applications may be used when approved by the COTR.
 - e. Work in freshly applied grout vigorously with a sponge rubber float, then let sit until some of its plasticity is gone but not until it loses its damp appearance. At this point it shall be rubbed with clean, dry burlap to remove the excess grout, leaving no visible film on the surface but filling all air holes.

- f. Keep the surface wet for a day after grouting and sack rubbing are completed.
- 7. Alternate methods of application and materials shall be subject to the approval of the COTR.

3.5 PATCHING

- A. Formed Surfaces:
 - 1. Promptly upon removal of contact forms and after concrete surfaces have been inspected, form ties shall be removed and all necessary patching and pointing shall be expertly done.
 - 2. Honeycombed areas shall be removed down to sound concrete, coated with a bonding grout or approved compound and patched using a low shrinkage high bond mortar. Patched areas shall be cured by being kept damp for at least 5 days.
 - 3. Tie holes shall be cleaned, dampened and filled solid with patching mortar or cement plugs of an approved variety.
- B. Slabs on Grade: After entire slab is finished, shrinkage cracks that may appear shall be patched as follows:
 - 1. Where slab is not exposed or where appearance is not important, cracks larger than 1/32 inch wide shall be filled with cement grout and struck off level with surface.
 - 2. Where slab is exposed and appearance is important, unsightly cracks shall be repaired in a manner satisfactory in appearance to Architect. If this cannot be accomplished, concrete shall be considered defective.

3.6 DEFECTIVE CONCRETE

- A. Defective concrete shall mean any of the following:
 - 1. Concrete not meeting 100 percent of the specified 28 day compressive strength.
 - 2. Concrete exhibiting rock pockets, voids, spalls, streaks, cracks, exposed reinforcing to extent that strength, durability, or appearance is adversely affected.
 - 3. Concrete significantly out of place, line, or level.
 - 4. Concrete not containing the required embedded items.
- B. Upon determination that concrete strength is defective:
 - 1. Should cylinder tests fall below minimum strength specified, concrete mix for remainder of Work shall be adjusted to produce required strength. Core samples shall be taken and tested from cast-in-place concrete where cylinders and samples indicate inferior concrete with less than minimum specified strength.
 - a. Cores of hardened concrete shall be taken and tested in accordance with ASTM C 42 and C 39. Number and location of such cores shall be subject to the approval of COTR.
 - b. Cost of core sampling and testing will be paid for by the Contractor.
 - c. "500 psi" and "85 percent" reduction in IBC Section 1905.6 will not justify low cylinder tests.

- C. Upon determining that concrete surface is defective, Contractor may restore concrete to acceptable condition by cutting, chipping, pointing, patching, grinding, if this can be done without significantly altering strength of structure. Permission to patch defective areas will not be considered a waiver of the right to require removal if patching does not, in the opinion of the COTR, satisfactorily restore quality and appearance.
- D. If core tests indicate that concrete is below the strength specified, or if patching does not restore concrete to specified quality and appearance, the concrete shall be deemed defective, and shall be removed and replaced without additional cost to the COTR.
- E. No repair Work shall begin until procedure has been reviewed by the COTR and Engineer.

3.7 GROUTING

- A. Prepare and place grout materials at locations as indicated on the Drawings in accordance with the manufacturer's recommendations and installation instructions.
- B. Pack grout materials solidly between bearing surfaces and bases or plates as indicated and to ensure no voids.

3.8 ADJUSTING AND CLEANING

- A. Remove all debris, excess materials, tools and equipment resulting from or used in this operation at completion of this Work.

END OF SECTION

SECTION 03 45 00

PRECAST ARCHITECTURAL CONCRETE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The Work of this Section includes the performance criteria, materials, production, and erection of architectural precast concrete cladding units. The Work performed under this Section includes all labor, material, equipment, related services, and supervision required for the manufacture and erection of the architectural precast concrete Work shown on the Construction Documents and includes the following:
 - 1. Caps for the columbarium walls.
 - 2. Cap for columbarium end pilaster.
 - 3. Caps for new retaining wall at end of columbarium wall.

1.2 RELATED WORK

- A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Concrete: Section 03 30 00, CAST-IN-PLACE CONCRETE.
- C. Precast Columbarium Units: Section 03 48 24 PRECAST CONCRETE COLUMBARIUM UNITS
- D. Mortar: Section 04 05 13, MASONRY MORTAR.
- E. Section 04 05 16, MASONRY GROUT.
- F. Masonry Facing: Section 04 20 00, UNIT MASONRY.
- G. Sealants and Caulking: Section 07 92 00, JOINT SEALANTS.
- H. Repair of abraded galvanized and painted surfaces: Section 09 91 00, PAINTING.

1.3 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm that complies with PCI MNL 117 and the following requirements and is experienced in producing units similar to those indicated for this Project and with a record of successful in-service performance:
 - 1. Assumes responsibility for engineering units to comply with performance requirements. A Comprehensive Engineering Analysis shall be performed by a qualified professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated.
 - 2. Participates in any nationally recognized Plant Certification program at the time of bidding.

3. Has sufficient production capacity to produce required units without delaying the Work.
- B. Erector Qualifications:
1. An erector with a minimum of 2 years of experience who has completed architectural precast concrete Work similar in material, design, and extent to that indicated for this Project and whose Work has resulted in construction with a record of successful in-service performance and who meets the following requirements:
 - a. Retains a nationally recognized Certified Field Auditor, at erector's expense, to conduct a field audit of a project in the same category as this Project prior to start of erection. Submits Erectors Post Audit Declaration.
 - b. The basis of the audit is the PCI MNL 127.
- C. Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required, comply with PCI MNL 117.
- D. Samples: For each precast component, fabricate and erect at site, one full size sample, illustrating shape, lifting device, and attachment points, and finish in accordance with approved sample.
1. Locate samples / panels where indicated or, if not indicated, as directed by COTR.
 2. Damage part of an exposed-face surface for each finish, color, and texture, and demonstrate adequacy of repair techniques proposed for repair of surface blemishes.
 3. After acceptance of repair technique, maintain one sample at the manufacturer's plant and one at the project site in an undisturbed condition as a standard for judging the completed Work.
 4. When any portion of the back face of precast concrete unit is to be exposed, show samples of the workmanship, color, and texture of the backup concrete as well as the facing.
 5. Demolish and remove samples only when directed.
- E. Mockups: After sample approval but before production of units, construct full sized mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Mockup to be representative of the finished Work in all respects including sealants and architectural precast concrete complete with all anchors, connections, flashings, and joint fillers as accepted on the final shop drawings. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
1. Build mockups in the location and of the size indicated or, if not indicated, as directed by COTR.
 2. Notify COTR in advance of dates and times when mockups will be constructed.
 3. Obtain COTR's approval of mockups before starting fabrication.
 4. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 5. Demolish and remove mockups only if directed.

6. Mock-ups may remain as part of the Work.

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide units and connections capable of withstanding: the design criteria specified on the Construction Documents, self weights and weights of materials supported or attached, for the conditions indicated.
 1. Design Standards: Comply with ACI 318 (ACI 318M) and the design recommendations of PCI MNL 120, applicable to types of units indicated.
 2. Design units to withstand actual loads such as wind, suction, deflection and thermal movement loads. Design for handling, transportation and erection stresses.
 3. Design for handling, transportation and erection stresses.
- B. Thermal Movements: Provide for in-plane thermal movements resulting from annual ambient temperature changes of 80 deg F. Use other values, greater or smaller, whenever justified by climatic conditions at the project site.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated. Retain quality control records and certificates of compliance for 5 years or period of warranty, whichever is greater.
- B. Design Mixes: For each concrete mix along with compressive strength and water-absorption tests.
- C. Shop (Erection) Drawings: Detail fabrication and installation of units.
 1. Indicate member locations with distinctive marks that match marks placed on the structures. Provide plans, elevations, dimensions, corner details, shapes, cross sections and relationships to adjacent materials including special reinforcement and lifting devices necessary for handling and erection.
 2. Indicate aesthetic intent including joints, reveals, and extent and location of each surface finish.
 3. Indicate separate face and backup mix locations, and thicknesses. Indicate locations, extent and treatment of dry joints if two-stage casting is proposed.
 4. Indicate welded connections by AWS standard symbols. Detail loose and cast-in hardware, and connections.
 5. Indicate locations, tolerances and details of anchorage devices to be embedded in or attached to structure or other construction.
 6. Indicate sequence of erection.
 7. Indicate locations and details of facing materials, anchors, and joint widths.
 8. Design Modifications:
 - a. If design modifications are necessary to meet the performance requirements and field conditions, submit design calculations and drawings. Do not adversely affect the appearance, durability or strength of units when modifying details or materials and maintain the general design concept.

- D. Samples: Design reference samples for initial verification of design intent, approximately 12 by 12 by full depth, representative of finishes, color, and textures of exposed surfaces of units.
- E. Samples for each unit required, showing the full range of color and texture expected. Supply sketch of each corner or special shape with dimensions. Supply sample showing color and texture of joint treatment.
 - 1. Precast units will be inspected at the site. Units which demonstrate lesser quality than accepted samples (outside the ranges established by the submitted and approved samples) shall not be acceptable.
 - 2. Submit non-shrink grout and sealants and caulk to be used with approved cap stones and obtain approval before manufacture of cap stones starts.
- F. Qualification Data for fabricator: List of completed projects with project names and addresses, names and addresses of owners, and other information specified.
- G. Material Test Reports: From a qualified testing agency indicating and interpreting test results of the following for compliance with requirements indicated:
 - 1. Concrete strengths and mix designs.
- H. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements.
 - 1. Concrete materials.
 - 2. Reinforcing materials.
 - 3. Admixtures.
 - 4. Bearing pads.
 - 5. Structural-steel shapes and hollow structural sections.
 - 6. Anchors.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Product handling requirements of PCI MNL 117 shall be followed at the plant and project site.
- B. Deliver all units to the project site in such quantities and at such times to assure compliance with the agreed project schedule and proper setting sequence so as to limit unloading units temporarily on the ground.
- C. Lift and support units only at designated points shown on the Shop Drawings.
- D. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, templates, instructions, and directions, as required, for installation.
- E. Carefully handle, transport, and store precast members to prevent damage of any kind. Broken, chipped, stained, or damaged units will be subject to rejection unless permission to repair such defects is obtained in writing from the COTR. Members may be shipped after attaining 90% of specified ultimate compressive strength, but not before reaching an age of 7 days.

- F. Units damaged after erection shall be either repaired or replaced as determined by the COTR. No repairs shall be made until the damaged unit has been examined by the COTR and a proposed repair procedure has been submitted to, and accepted by, the COTR in writing. The COTR may require that repairs be made by the manufacturer. Costs for repair Work shall be borne by the Contractor.
- G. Cover precast units to protect from soiling or damage by subsequent building operations, using reinforced building paper or other material acceptable to the COTR.

1.7 Warranty

- A. Warranty of precast concrete Work, including anchorage, joint treatment and related components to be free from defects in materials and workmanship, including cracking and spalling.
- B. After erection, completed Work will be weathertight, subject to terms of Article "Warranty of Construction" FAR clause 52.246-21, except warranty period is extended to five years.

1.8 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of specification to extent referenced. Publications are referenced in text by basic designation only. Use the latest edition of the referenced publication.
- B. American Society for Testing and Materials (ASTM):
 - A27 Steel Castings, Carbon, for General Application
 - A82 Steel Wire, Plain, for Concrete Reinforcement
 - A108 Steel Bar, Carbon and Alloy, Cold-Finished
 - A123 Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - A153 Zinc Coating (Hot-Dip) on Iron and Steel Hardware
 - A167 Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
 - A184 Fabricated Deformed Steel Bar Mats for Concrete Reinforcement
 - A185 Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
 - A276 Stainless Steel Bars and Shapes
 - A283 Low and Intermediate Tensile Strength Carbon Steel Plates
 - A307 Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
 - A325 Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength

A416	Steel strand, Uncoated Seven-Wire for Prestressed Concrete
A490	Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength
A496	Steel Wire, Deformed, for Concrete Reinforcement
A497	Steel Welded Wire Reinforcement, Deformed, for Concrete
A500	Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
A563	Carbon and Alloy Steel Nuts
A572	High-Strength Low-Alloy Columbium-Vanadium Structural Steel
A615	Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
A666	Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
A675	Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties
A706	Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
A767	Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement
A775	Epoxy-Coated Steel Reinforcing Bars
A780	Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
A884	Epoxy-Coated Steel Wire and Welded Wire Fabric for Reinforcement
A934	Epoxy-Coated Prefabricated Steel Reinforcing Bars
B227	Hard-Drawn Copper-Clad Steel Wire
B633	Electrodeposited Coatings of Zinc on Iron and Steel
C33	Concrete Aggregates
C40	Organic Impurities in Fine Aggregate for Concrete
C150	Portland Cement
C260	Air-Entraining Admixtures for Concrete
C330	Lightweight Aggregates for Structural Concrete
C373	Test Method for Water Absorption, Bulk Density, Apparent Porosity, and Apparent Specific Gravity of Fired Whiteware Products
C494	Chemical Admixtures for Concrete
C618	Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
C881	for Epoxy-Resin-Base Bonding Systems for Concrete
C979	Pigments for Integrally Colored Concrete
C989	Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars

- C1017 Chemical Admixtures for Use in Producing Flowing Concrete
- C1107 Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
- C1218 Test Method for Water-Soluble Chloride in Mortar and Concrete
- C1240 Silica Fume Used in Cementitious Mixtures
- D412 Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension
- D2240 Test Method for Rubber Property—Durometer Hardness
- F436 Hardened Steel Washers
- F568M Carbon and Alloy Steel Externally Threaded Metric Fasteners
- F593 Stainless Steel Bolts, Hex Cap Screws, and Studs
- F844 Washers, Steel, Plain (Flat), Unhardened for General Use

- C. American Concrete Institute (ACI):
 - ACI 211.1-91 Selecting Proportions for Normal, Heavyweight and Mass Concrete (Reapproved 2002)
 - ACI 318 (318R) Building Code Requirements for Structural Concrete

- D. Precast/Pre-stressed Concrete Institute (PCI):
 - MNL-117 Quality Control for Plants and Production of Architectural Precast Concrete Products
 - MNL-120 Design Handbook – Precast and Prestressed Concrete
 - MNL-127 Erector's Manual - Standards and Guidelines for the Erection of Precast Concrete Products
 - TR-6-03 Interim Guidelines for the Use of Self-Consolidating Concrete

- E. Structural Steel Painting Council (SSPC):
 - SSPC-Paint 20 Zinc-Rich Primers (Type I, Inorganic, and Type II, Organic).

PART 2 - PRODUCTS

2.1 MOLD MATERIALS

- A. Molds: Rigid, dimensionally stable, non-absorptive material, warp and buckle free, that will provide continuous and true precast concrete surfaces within fabrication tolerances indicated; non-reactive with concrete and suitable for producing required finishes:
 - 1. Mold-Release Agent: Commercially produced liquid-release agent.

- B. Form Liners: Units of face design, texture, arrangement, and configuration indicated.

- C. Reinforcement dowels and connections shall be securely and accurately placed as shown on the Construction Documents. Connection hardware shall be rigidly attached to the forms, or otherwise positively prevented from moving in any direction. Means of support shall be subject to the approval of the COTR.
- D. In general, forms may be designed with a draft of 1/8" in 12", and all forms may have 1/8" radius corners to facilitate removal and reduce breakage.

2.2 REINFORCING MATERIALS

- A. Reinforcing Steel: ASTM A615, Grade 60 (Grade 420), deformed.
- B. Weldable Reinforcing Bars: ASTM A706, deformed.
 - 1. Deformed-Steel Welded Wire Reinforcement: ASTM A497, flat sheet.
- C. Plain Steel Wire: ASTM A 82, as drawn
- D. Plain Steel Welded Wire Fabric: ASTM A185
- E. Supports: Place reinforcement according to PCI MNL 117.

2.3 CONCRETE MATERIALS

- A. Portland Cement: ASTM C150, Type I or III.
- B. Normal-Weight Aggregates: Except as modified by PCI MNL 117, ASTM C33, with coarse aggregates complying with Class 5S
- C. Fine aggregate: ASTM C33; Washed, inert sand with color characteristics to produce concrete of a color which exactly matches the designated sample (silica sands required).
- D. Admixtures: Admixtures containing calcium chloride, or more than 0.15 percent chloride ions or other salts by weight of admixture are not permitted.
 - 1. Coloring Admixture: ASTM C979, synthetic or natural mineral-oxide pigments or colored water-reducing admixtures, temperature stable and non-fading.
 - 2. Air Entraining Admixture: ASTM C260, certified by manufacturer to be compatible with other required admixtures.
 - 3. Water-Reducing Admixture: ASTM C494/C494M, Type A.
 - 4. Retarding Admixture: ASTM C494/C494M, Type B.
 - 5. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
 - 6. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
 - 7. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.
 - 8. Plasticizing Admixture for Flowable Concrete: ASTM C1017/C1017M.

2.4 STEEL CONNECTION MATERIALS

- A. Carbon-Steel Shapes and Plates: ASTM A36/A36M.

- B. Carbon-Steel Headed Studs: ASTM A108, Grades 1018 through 1020, cold finished of PCI MNL 117, Table 3.2.3.; AWS D1.1, Type A or B, with arc shields.
- C. Carbon-Steel Plate: ASTM A283/A283M.
- D. Carbon-Steel Castings: ASTM A27/A27M, Grade U-60-30 (Grade 415-205).
- E. High-Strength, Low-Alloy Structural Steel: ASTM A572/A572M.
- F. Carbon-Steel Structural Tubing: ASTM A500, Grade B.
- G. Wrought Carbon-Steel Bars: ASTM A675/A675M, Grade 65 (Grade 450).
- H. Deformed-Steel Wire or Bar Anchors: ASTM A496 or ASTM A706/A706M.
- I. Carbon-Steel Bolts and Studs: ASTM A307, Grade A (ASTM F568M, Property Class 4.6) carbon-steel, hex-head bolts and studs; carbon-steel nuts (ASTM A563/A563M, Grade A); and flat, unhardened steel washers (ASTM F844).
- J. High-Strength Bolts and Nuts: ASTM A325/A325M or ASTM A490/A490M, Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, (ASTM A563/A563M) and hardened carbon-steel washers (ASTM F436/F436M).
- K. Finish: For exterior steel items and items indicated for galvanizing, apply zinc coating by hot-dip process according to ASTM A123/A123M, after fabrication, or ASTM A153/A153M, as applicable electrodeposition according to ASTM B633, SC 3, Type 1.
 - 1. Galvanizing Repair Paint: High-zinc-dust-content paint with dry film containing not less than 94 percent zinc dust by weight, and complying with SSPC-Paint 20.
- L. Welding Electrodes: Comply with AWS standards.

2.5 GROUT MATERIALS

- A. Non-metallic, Non-shrink Grout: Premixed, nonmetallic, noncorrosive, non-staining grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C1107, Grade A for drypack and Grades B and C for flowable grout and of a consistency suitable for application within a 30-minute working time.

2.6 CONCRETE MIXES

- A. Prepare design mixes to match COTR's sample for each type of concrete required.
- B. Design mixes shall be prepared by a qualified independent testing agency or by qualified precast plant personnel at fabricator's option.
- C. Limit water-soluble chloride ions to the maximum percentage by weight of cement permitted by ACI 318 or PCI MNL 117 when tested in accordance with ASTM C1218.

- D. Proportion mixes by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on project, to provide normal-weight concrete with the following properties:
 - 1. Compressive Strength (28 Days): 5000 psi.
 - 2. Maximum Water-Cementitious Materials Ratio: 0.45.
 - 3. Release Strength at Transfer of Prestress: 3500 psi.
- E. Water Absorption: 6 percent by weight or 14 percent by volume, tested according to PCI MNL 117.
- F. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 117.
- G. When included in design mixes, add other admixtures to concrete mixes according to manufacturer's written instructions.

2.7 MOLD FABRICATION

- A. Molds: Accurately construct and maintain molds, mortar tight, of sufficient strength to withstand pressures due to concrete-placement and temperature changes.
 - 1. Form joints are not permitted on faces exposed to view in the finished Work.
 - 2. Edge and Corner Treatment: As indicated
 - 3. Place form liners accurately to provide finished surface texture indicated. Provide solid backing and supports to maintain stability of liners during placing of concrete.
 - 4. Coat contact surfaces of molds with release agent.

2.8 FABRICATION

- A. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.
- B. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing units to supporting and adjacent construction.
- C. Cast-in reglets, slots, holes, and other accessories in units as indicated.
- D. Cast-in openings larger than 10 inches in any dimension.
- E. Reinforcement: Comply with recommendations in PCI MNL 117 for fabrication, placing, and supporting reinforcement.
 - 1. Place reinforcing steel and prestressing strand to maintain at least 3/4 inch minimum concrete cover. Increase cover requirements for reinforcing

- steel to 1-1/2 inches when units are exposed to corrosive environment or severe exposure conditions. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete.
2. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh spacing and wire tie laps, where required by design. Offset laps of adjoining widths to prevent continuous laps in either direction.
 3. Built-In Items: Provide slots, holes, and other accessories in units to receive dowels and other similar Work as indicated.
 4. Anchorages: Provide loose dowels and other miscellaneous steel shapes not provided by other trades, necessary for securing precast units to supporting and adjacent members.
- F. Pre-stress tendons for units by pre-tensioning methods. Comply with PCI MNL 117.
- G. Mix concrete according to PCI MNL 117 and requirements in this Section. After concrete batching, no additional water may be added.
- H. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in precast concrete units. Comply with requirements in PCI MNL 117 for measuring, mixing, transporting and placing concrete.
- I. Identify pickup points of units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each unit on a surface that will not show in finished structure.
- J. Cure concrete, according to requirements in PCI MNL 117, by moisture retention without heat or radiant heat and moisture.
- K. Repair damaged units to meet acceptability requirements of PCI MNL 117 and the COTR.

2.9 FABRICATION TOLERANCES

- A. Fabricate units straight and true to size and shape with exposed edges and corners precise and true so each finished unit complies with PCI MNL 117 product tolerances as well as position tolerances for cast-in items.
1. Additional Position Tolerances: For cast-in items measured from datum line location, as indicated on Shop Drawings.
 - a. Weld Plates: Plus or Minus 1 inch.
 - b. Inserts: Plus or Minus 1/2 inch.
 - c. Handling Devices: Plus or Minus 3 inch.
 - d. Reinforcing Steel or Wire Fabric in a structural location: Plus or Minus 1/4 inch.
 - e. Reinforcing Steel or Wire Fabric in a non-structural location: Plus or Minus 1/2 inch.
 - f. Reinforcing Steel extending out of a member: Plus or Minus 1/2 inch.
 - g. Rustication Joints: Plus or Minus 1/8 inch.

- h. Openings: Plus or Minus 1/4 inch.
 - i. Flashing Reglets: Plus or Minus 1/4 inch.
 - j. Flashing Reglets, Panel Edge: Plus or Minus 1/8 inch.
 - k. Rotation of Plate, Electrical Boxes or Channel Inserts: Plus or Minus 1/4 inch or 2 degrees.
- B. In addition to tolerances of individual elements required by American Concrete Institute Publication 533.3R, erection tolerances shall be as follows:
 - 1. Variation of anchors and fasteners from dimensions specified 1/8-inch
 - 2. Variation in overall dimensions of precast element (height and width) 1/8-inch
 - 3. Maximum differential between adjacent units in erected position... 1/4-inch
 - 4. Variation in thickness of precast panels and elements 1/8-inch
 - 5. Maximum vertical differential between adjacent columbarium units in installed position 1/8-inch
- C. Fabricate architectural trim units with tolerances meeting PCI MNL 135.

2.10 FINISHES

- A. Units shall be free of joint marks, grain, and other obvious defects. Corners, including false joints shall be uniform, straight and sharp, except where radius corner details are specified. Finish exposed-face surfaces of units to match approved sample panels, mockups, and as follows:
 - 1. Face-Down Finishes (Exterior Exposed Surface):
 - a. All surfaces with exterior exposure shall be cast face-down.
 - b. Smooth, As-Cast Finish: Where panel face is smooth, cast panel to produce a surface free of pockets, bugholes, sand streaks, and honeycombs. Produce a surface appearance of uniform color and texture. Surfaces shall have a smooth, cut stone appearance.
- B. Finish unexposed surfaces of units by steel trowel finish.

2.11 SOURCE QUALITY CONTROL

- A. Quality-Control Testing:
 - 1. Test and inspect precast concrete according to Section 01 45 29, TESTING LABORATORY SERVICES and PCI MNL 117 requirements respectively.
 - 2. If using self-consolidating concrete also test and inspect according to PCI TR-6.
 - 3. Strength of precast panels must meet the requirements of ACI 318.
- B. Testing: If there is evidence that the concrete strength of precast concrete units may be deficient, Precaster will employ an independent testing agency to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to PCI MNL 117:
 - 1. Test results will be made in writing on the same day that tests are performed, with copies to COTR, Contractor, and precast concrete fabricator. Test reports will include the information required in Section TESTING LABORATORY SERVICES and the following:

- a. Identification mark and type of precast concrete units represented by core tests; design compressive strength; type of break; compressive strength at breaks, corrected for length-diameter ratio; and direction of applied load to core in relation to horizontal plane of concrete as placed.
- C. Defective or Damaged Work: Units that do not comply with acceptability requirements, including concrete strength, manufacturing tolerances, and color and texture range are unacceptable. Chipped, spalled or cored units may be repaired, if repaired units match the visual mock-up. The COTR reserves the right to reject any unit if it does not match the accepted samples and visual mock-up. Replace unacceptable units with precast concrete units that comply with requirements.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prior to installation of any of the Work in this Section, Contractor shall inspect the planned installation locations to insure that conditions are not significantly different from those indicated on the Construction Documents. All materials shall be inspected prior to installation to insure compliance with the Contract Documents and to insure there is no damage. Should conditions be different from those indicated on the Contract documents, Contractor shall immediately notify the COTR.
- B. All Material must be checked upon receipt at the job site prior to installation to check for any damage that may have occurred during transport.
- C. Deliver anchorage devices that are embedded in or attached to the building structural frame or foundation before start of such Work. Provide locations, setting diagrams, and templates for the proper installation of each anchorage device.
- D. Examine supporting structural frame or foundation and conditions for compliance with requirements for installation tolerances, true and level bearing surfaces, and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.
- E. Do not install units until supporting structural framing has attained minimum allowable design strength or supporting steel or other structure is structurally ready to receive loads from precast.

3.2 ERECTION

- A. Erect level, plumb and square within the specified allowable tolerances. Provide temporary supports and bracing as required to maintain position, stability, and alignment of units until permanent connections are completed. Align with existing wall cap units that are to remain in place.

1. Install temporary steel or plastic spacing shims or bearing pads as precast concrete units are being erected. Tack weld steel shims to each other to prevent shims from separating.
 2. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
 3. Remove projecting lifting devices and use sand-cement grout to fill voids within recessed lifting devices flush with surface of adjacent precast concrete surfaces when recess is exposed.
 4. Unless otherwise shown provide for uniform joint widths of 3/4 inch.
- B. Connect units in position by bolting, welding, grouting, or as otherwise indicated on approved Erection Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and/or grouting are completed.
1. Disruption of roof flashing continuity by connections is not permitted; concealment within roof insulation is acceptable.
 2. Welding: Comply with applicable requirements for welding.
 - a. Protect units and bearing pads from damage by field welding or cutting operations and provide noncombustible shields as required.
 - b. Welds not specified shall be continuous fillet welds, using not less than the minimum fillet as specified by AWS.
 - c. Clean weld affected metal surfaces and apply a minimum 100 µm (0.004 inch) thick coat of galvanized repair paint to galvanized surfaces in conformance with ASTM A780.
 - d. Visually inspect all welds critical to precast connections. Visually check all welds for completion and remove, reweld or repair all defective welds.
 3. At bolted connections, use lock washers, tack welding, or other acceptable means to prevent loosening of nuts after final adjustment.
 - a. Where slotted connections are used, verify bolt position and tightness. For sliding connections, properly secure bolt but allow bolt to move within connection slot. For friction connection apply specified bolt torque and check 25 percent of bolts at random by calibrated torque wrench.
 4. Grouting Connections: Grout connections where required or indicated. Retain grout in place until hard enough to support itself. Pack spaces with stiff grout material, tamping until voids are completely filled. Place grout to finish smooth, level, and plumb with adjacent concrete surfaces. Promptly remove grout material from exposed surfaces before it affects finishes or hardens.
- C. Attachments: Upon approval of COTR, precast pre-stressed products may be drilled or "shot" for fasteners or small openings. Provided reinforcing or pre-stressing steel is not damaged or cut.
1. Should spalling occur, repair according to this specification Section.
- D. Setting: Where shown, fill joints with cement mortar specified in Section 04 05 13, MASONRY MORTAR and Section 04 05 16, MASONRY GROUT.
1. Clean surfaces forming beds and other joints for precast concrete panels of dust, dirt, and other foreign matter, and wet thoroughly to prevent suction before precast concrete, elements are set.

2. Set precast element level and true to line with uniform joints filled completely with mortar.
 - a. Rake out joints 1-inch deep for sealants.
 - b. Joints required to have only sealant: Kept free of mortar for full depth.
 3. Keep exposed faces of precast concrete elements free of mortar.
 4. Remove wedges, spacers, or other appliances which are likely to cause staining from joints.
 5. Where parging is shown, parge back of elements solid with mortar. Apply parging without skips or holidays.
- E. Sealing of Joints: Where shown and where required to make Work watertight: clean, dry and seal joints between precast concrete elements and between precast elements and adjoining materials as specified in Section 07 92 00, JOINT SEALANTS.

3.3 ERECTION TOLERANCES

- A. Erect units level, plumb, square, true, and in alignment without exceeding the erection tolerances of PCI MNL 117, Appendix I.

3.4 FIELD QUALITY CONTROL

- A. Refer to Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Testing agency will report test results promptly and in writing to Contractor and COTR.
- C. Repair or remove and replace Work that does not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.

3.5 REPAIRS

- A. Repairs will be permitted provided structural adequacy of units and appearance are not impaired.
- B. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired Work, when viewed in typical daylight illumination from a distance of 20 feet.
- C. Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A780.
- D. Remove and replace damaged units when repairs do not meet requirements.

3.6 CLEANING

- A. Clean all surfaces of precast concrete to be exposed to view, as necessary, prior to shipping.
- B. Clean mortar, plaster, fireproofing, weld slag, and any other deleterious material from concrete surfaces and adjacent materials immediately.
- C. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.
 - 1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's recommendations. Clean soiled precast concrete surfaces with detergent and water, using stiff fiber brushes and sponges, and rinse with clean water. Protect other Work from staining or damage due to cleaning operations.
 - 2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

END OF SECTION

SECTION 03 48 24

PRECAST CONCRETE COLUMBARIUM UNITS

PART 1 - GENERAL

1.1 SUMMARY

- A. This section covers the manufacture and installation of replacement precast concrete columbarium units, as shown on the drawings and specified herein, including but not limited to: the steel reinforcement, steel embedment plates, required sleeves, finished exposed surfaces, preparation of setting surface, adhesive, columbarium fasteners, and niche cover anchor clip assemblies.
- B. Acceptable designs of the columbarium units components are provided as shown on the Drawings. The Contractor may use this design for this Work or may propose alternate designs of the corresponding components as follows:
 - 1. Design for alternate columbarium units shall comply with the design criteria as per Articles 1.3.F and further, if required by the Contractor, shall comply with the functional tests as per Article 1.3.G of this Specification.
 - 2. Unless indicated otherwise, all provisions of this Specification shall apply to the Contractor proposed design.
- C. The Government may accept or reject part or all of any design proposed by the Contractor.
- D. This section includes finishing and staining/coating of exposed faces of the columbarium units as indicated on drawings or described herein.
- E. This section covers installation of the Government-furnished (existing), Contractor-re-installed niche covers, one for each existing or replacement niche of the existing or replacement columbarium units.

1.2 RELATED DOCUMENTS

- A. Section 31 20 00, EARTH MOVING
- B. Section 03 30 00, CAST-IN-PLACE CONCRETE for Cast-in-place concrete work.
- C. Section 04 20 00, UNIT MASONRY for stone work.
- D. Section 07 92 00, JOINT SEALANTS, Materials and Workmanship for sealant application.

1.3 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Prior to commencement of work, Contractor shall submit documentation regarding the experience of his precast concrete supplier in the design and manufacture of Precast Concrete structures and custom units.

- B. Precast concrete manufacturer's qualified Registered Professional Structural Engineer to certify that precast reinforced concrete conforms to specified requirements.
- C. Codes and regulations of the Federal, State and County authorities shall apply.
- D. Fabricate to dimensions shown or approved. Replace or correct Columbarium Units that do not comply with the individual dimensions and tolerances.
- E. Before starting production of precast concrete Columbarium Units, furnish at the site, two complete Precast Concrete Columbarium Units, to demonstrate quality of construction. Commence production of Columbarium Units only after written approval has been obtained from the Contractor.
- F. Design Criteria:
 - 1. The Columbarium Units shall be of the following type, style, and size:
 - a. Type: Precast concrete, reinforced.
 - b. Size: Interior and exterior dimensions as indicated on plans.
 - 2. Columbarium top shall be capable of structurally supporting imposed service live load of no less than 240 Kgs./Square Meter (50 lb./ ft²), and dead loads based on stone veneer thickness and heights, including material composition and element section properties, mortar and grout, and dead loads based on concrete top element sectional properties.
 - 3. The Contractor shall submit to the COTR for review and approval 5 sets of design documentation showing structural design of the complete Columbarium. This documentation shall include dimensions, methods of construction, and calculations. All design calculations and drawings shall be signed and sealed by qualified Professional Structural Engineer.
- G. Functional Load Tests: If required by the COTR, a functional load test will be made at the Contractor's expense to insure that the columbarium proposed by the Contractor, as furnished, will be capable of supporting loads stated in Article 1.3.F.2. The functional test will consist of two loading conditions:
 - 1. Unconfined Loading: The columbarium will be placed on a flat surface with no support against the sides. The entire top of the columbarium will be subjected to a simulated uniform load of live load of 50 lb./ft² and required dead load simulating stone veneer, mortar, and grout as they will be installed. The load will be maintained for no less than 72 hours. At end of the loading period, the maximum deflection of the Columbarium top elements shall be no more than 1/8". Upon removal of the load from the unit the residual deflection shall be no more than 1/16" and concrete elements shall be free of all structural distress.

1.4 MANUFACTURER / INSTALLER QUALIFICATIONS

- A. Precast concrete columbarium units shall be product of manufacturer / installer who has a minimum of 3 years experience in fabrication and erection of the precast concrete columbarium units similar in material design and extent to that indicated on the drawings and specified herein.

- B. Supply and Installation of fastener system shall be by a product manufacturer and installer, both whom have had a minimum of 3 years experience in installation of similar design as indicated on the drawing.
- C. Installation of niche fronts will be performed by those companies who have had 3 years experience in installation of similar design as indicated in the drawings and specified herein.

1.5 ALLOWABLE TOLERANCES

- A. In addition to tolerances of individual elements required by American Concrete Institute Publication 533.3R, erection tolerances shall be as follows:

Variation of anchors and fasteners from dimensions specified	1/8"
Variation in overall dimensions of precast element (height and width)	1/8"
Maximum differential between adjacent units in erected position	1/4"
Variation in thickness of precast panels and elements.	1/8"
Maximum vertical differential between adjacent columbarium units in installed position	1/8"

1.6 SUBMITTALS

- A. In accordance with Division 1 Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, and SAMPLES, furnish the following:
 - 1. Samples: Submit sample of all fastening systems, mounting hardware and exposed surface finishes including, but not limited to, the following:
 - a. Stainless Steel Angle
 - b. Stainless Steel Bolt, Nut and Washers
 - c. Tamper Proof Stainless Steel Bolt
 - d. Stainless Steel Rosette
 - e. Stainless Steel Expansion Anchors, Bolts and pins
 - f. Stainless Steel Ferrule loop insert.
 - g. Shims
 - h. Exposed front of columbarium with coating applied (If coating is required).
 - i. Adhesives and grouts.
 - 2. Shop Drawings: Complete shop and erection drawings of all precast concrete columbarium units, showing all dimensions and details of construction, installation and relation to adjoining work, reinforcements, anchorage, attachments, inserts, location of all pre-drilled sleeves and other items to be installed in the work of other trades, joint treatment, joint alignment coordinated with cap stone joints, and other work required for a complete installation. Provide evidence that the Contractor to be installing the cast in place concrete foundations for the columbarium and pier units has been contacted prior to any work relating to the footings for the columbarium construction, and that the construction of the concrete support (foundations) work has been coordinated with the precast columbarium unit manufacturer and installer.
 - 3. Production Drawings:
 - a. Elevation view of each structural element.
 - b. Planametric view of unit.

- c. Sections and details to show quantities and position of reinforcing steel, anchors, inserts, and essential embedded and non-embedded hardware for fabrication, handling, transportation and installation.
- d. Lifting and erection inserts.
- e. Dimensions and finishes.
- f. Method of transportation.
- g. Method of erection and handling.
- 4. Manufacturer's Literature and Data:
 - a. Each type of Concrete Fastener, including adhesive and anchor devices.
 - b. Instructions for final cleaning
 - c. Concrete stain/coating, including color charts of manufacturers standard color palette (If applicable for this project.)
- 5. Certificates: Manufacturers qualifications specifying precast concrete columbarium units meet the requirements of ACI 533.3R and as specified.

1.7 DELIVERY, STORAGE

- A. Ship precast concrete columbarium units to site with adequate protection to prevent chipping, breaking and other damage. Materials shall be marked giving proper identifications and location. Store materials in protected areas to prevent damage, injurious effects of weather and inclusion of foreign matter.

1.8 COORDINATION

- A. Coordinate the manufacture and erection of precast concrete columbarium units with related work of other sections of the Specifications. Provide templates for inserts and other devices for anchoring precast concrete columbarium units to the work of other trades, in sufficient time to be built into adjoining construction. Perform cutting, fitting and other related work in connection with erection of precast concrete columbarium unit work. See Shop Drawing section for details regarding the coordination of work.

1.9 GUARANTEE

- A. Guarantee precast concrete columbarium unit work, including anchorage, joint treatment and related components to be free from all defects in materials and workmanship, including cracking and spalling, and after erection, completed work will be subject to terms of "Guarantee" article in Division 1 Specification Sections except that guarantee period is one year.

1.10 APPLICABLE PUBLICATIONS

- A. The publications listed below from a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. Federal Specifications (Fed. Spec.):
QQ-S-766C (5)..... Steel Plates, Sheets, and Strip-Corrosion Resisting

QQ-W-423B..... Wire, Steel, Corrosive-Resisting
TT-S-00227E (3) Sealing Compound Elastomeric Type, Multi-Component
(For Caulking, Sealing, And Glazing In Building And Other
Structures)
TT-S-00230C (2)..... Sealing Compound: Elastomeric Type, Single Component
(For Caulking, Sealing and Glazing In Building and Other
Structures)

- C. American Concrete Institute (ACI) Publications:
ACI 533.3R-70..... Fabrication, Handling And Erection of Precast Concrete.
- D. American Society for Testing Materials (ASTM) Standards:
A36/A36M-08 Structural Steel
A82/A82M-07 Steel Wire, Plain, for Concrete Reinforcement
A185/A185M-07 Welded Steel Wire Fabric for Concrete Reinforcement.
A615/A615M-08b Deformed and Plain Billet-Steel Bars for Concrete
Reinforcement.
C33-08..... Concrete Aggregates
C150-07..... Portland Cement
- E. American Welding Society (AWS) Publications:
AWS D1.1-90..... Structural Welding Code
AWS D1.4-80..... Welding Reinforcing Steel

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURER/DESIGN

- A. Manufacturer's that have previously completed at least one successful NCA columbarium project are deemed to be acceptable for processing their units through the procedures according to these specifications and the drawings.
- B. Manufacturer's that do not have previous successful experience for a NCA columbarium project may be selected by the Contractor for the project. Contractor is hereby notified that the submittal process for a manufacturer with no previous NCA experience with a successful columbarium project, typically takes longer to process.

2.2 COARSE AGGREGATE

- A. Hard durable aggregate carefully graded from coarse to fine in proportions required to match approved samples.

2.3 AGGREGATE FOR BACK-UP MIX (FINE AND COARSE AGGREGATE LIGHTWEIGHT):

- A. ASTM C33. Limit gradation as required to produce the specified appearance and quality of concrete.

2.4 PORTLAND CEMENT

- A. ASTM C150, Type I and Type II; Color as required.

2.5 STRUCTURAL STEEL

- A. ASTM A36.

2.6 STEEL FABRIC REINFORCEMENT

- A. ASTM A185, galvanized.

2.7 STEEL WIRE REINFORCEMENT

- A. ASTM A82, cold drawn.

2.8 REINFORCING STEEL

- A. ASTM A615, deformed, Grade 60.

2.9 MISCELLANEOUS GALVANIZED STEEL ITEMS

- A. Bolts, nuts, washers, anchors, inserts, and the like for handling, erection, or use by other trades.

2.10 MARBLE NICHE COVERS

- A. Existing marble niche covers shall be removed, stored, and reinstalled after wall repair is complete. Any additional covers needed due to damage of existing covers shall be furnished by the Government and delivered to the site on pallets and shall be of size, type, finish and quantities required for this project. Contractor and Government representatives shall inspect the niche covers upon delivery to the site. The general quantity and condition shall be observed and an adequate count to cover all the installed columbarium units, plus required spares shall be verified, once the niche covers are accepted at the site, they shall become the Contractors responsibility until installed and the installation is accepted by the COTR.

2.11 NICHE COVER ATTACHMENT HARDWARE

- A. Existing attachment hardware to be salvaged and reinstalled. Replacement hardware shall be United States Department of Military and Veterans Affairs, National Cemetery System, standard stainless steel rosette, mounting brackets, and bolts for complete attachment of the niche covers to the precast columbarium units.

2.12 BACK-UP MATERIAL

- A. Closed cell neoprene, butyl, polyurethane, vinyl or polyethylene foam rod, diameter approximately 1-1/3 times the joint width.

2.13 BOND BREAKERS IF USED

- A. Type and material recommended by sealant manufacturer.

2.14 SEALING COMPOUND IF USED

- A. Fed. Spec. TT-S-00230 C, Type II, Class A, or ASTM C 920-87, Type S, Grade NS, Class 25.

2.15 FABRICATION

- A. Precast concrete columbarium units shall NOT be: fabricated, delivered or incorporated in the work until samples have been approved. Precast concrete shall comply with ACI 533.3R, except as modified herein.
1. Concrete for precast columbarium units shall have minimum compressive strength of 34.5 MPa (5,000 psi) at 28 days.
 2. Provide additional steel reinforcing as required for casting, handling and erection loads.
 3. Back-up Mix: Porosity, strength, weight and gradation of coarse aggregate shall be as required to produce specified characteristics.
 4. Columbarium units shall be cast in steel forms designed to suit shape and finish required and to withstand high frequency vibration. Concrete shall be deposited in oiled forms. Form oil shall be non-staining type. Vibrations, where required, shall be continuous during process of casting to attain through compaction, complete embedment of reinforcement and to assure concrete of uniform and maximum density without segregation of mix and full thickness of precast element is attained.
 - a. Anchors, lifting devices, provisions for cutouts and openings, dovetail slots, notches, reglets, inserts and similar items required for the work of other trades shall be accurately positioned in forms before casting elements.
 - b. All fastener location holes, including those for anchoring of units and attachment of niche covers, shall be cast into units. Drilling to precast concrete columbarium units, after fabrication, shall not be acceptable.
 5. Cement, aggregate and water shall be obtained from single sources for facing mix of precast concrete work in order to assure regularity of appearance and uniformity of color.
 6. Finish: Exposed faces shall have smooth finish, free of bugholes, unless otherwise noted. The face of the units shall be processed by the manufacturer, following removal from the forms to insure that the discoloration and blemishes on the niche faces are removed before shipping to the site.
 7. Curing: Precast concrete shall be cured as required to develop specified structural characteristics and shall be stored in a manner that will permit all surfaces to cure equally and minimize warping, without staining the exposed faces.

PART 3 - EXECUTION

3.1 HANDLING AND INSTALLATION

- A. Before beginning installation, inspect work of other trades in-so-far as it effects the work of this Section. Commencing installation of precast concrete columbarium units will be construed as acceptance, as suitable, of such work of other trades. Concrete base for the columbarium units shall be inspected and modified as required, grinding off high spots, to become an acceptable base upon which to install the units. Columbarium units shall be handled in a nearly vertical plane at all times and stacked vertically on wood supports of adequate strength, until erected. Cover and protect precast concrete columbarium units against staining and other damage. Reinstall, realign and otherwise correct improper installed units.
 - 1. Accurately place and securely anchor precast concrete columbarium units to adjoining construction in accordance with approved shop and erection drawings.

3.2 SETTING

- A. Where shown, joints shall be filled with sealant. Surfaces and other joints for precast concrete columbarium units shall be cleaned of all dust, dirt and other foreign matter. Exposed surfaces of units shall either be protected by anti-graffiti coating at the manufacturer, or shall be protected until accepted by the VA following installation. Units that have been damaged on exposed surfaces by graffiti, when not coated in advance shall be rejected and removed from the site. Each precast element shall be set level and true to line with uniform joints. Joints required to have sealants shall be kept free of dirt and other contaminants for their full depth. Precautions shall be taken to protect precast concrete work from being damaged and soiled during and after installation. Wedges, spacers or other appliances which are likely to cause staining shall be removed from joints.

3.3 SEALING OF JOINTS

- A. Where shown and/or where ever required to make the work watertight, joints between precast concrete columbarium units and between other precast elements and adjoining masonry, concrete and other materials shall be filled with back-up material for depth extending as required to form joint of depth as shown or recommended by sealant manufacturer. Provide bond breakers, at base of sealant where space for back-up does not exist and to prevent sealant from bonding to material at base of joint.
 - 1. Workmanship shall be in accordance with Division 1 Specification Sections.

3.4 CLEANING

- A. After erection is complete, clean precast columbarium units using materials, equipment and methods recommended by manufacturer.

3.5 REPLACEMENT AND REPAIR

- A. Precast concrete columbarium units which are damaged, cracked, stained, improperly fabricated or otherwise defective shall be removed and be replaced. Precast units having minor defects not affecting serviceability or appearance may be repaired when approved by the Owners Designated Representative. Repaired work shall be sound, permanent, flush with adjacent surfaces and of color and texture matching similar adjoining surfaces and shall show no line of demarcation between original and patched surfaces. Replacement and repairs shall be done at no additional cost to the Government.

3.6 INSTALLATION OF NICHE COVERS

- A. Install niche covers plumb and level as shown so that exposed faces of niche covers lie in the same plane and that rows of niche covers align both horizontally and vertically. Tighten fasteners to achieve snug fit but do not over tighten to the point where they may crack or break niche covers. Due to the manufacturing tolerances in the niche covers and the allowable deviations from the nominal dimensions, it will be impossible to install the niche covers perfectly. Coordinate the installation procedures with the COTR and establish the critical visual line for which the best alignment is to be established.

END OF SECTION

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SECTION 04 05 13

MASONRY MORTAR

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The Work of this Section specifies mortar materials and mixes.

1.2 RELATED WORK:

- A. Mortar used in Section:
1. Section 03 45 00, PRECAST ARCHITECTURAL CONCRETE.
 2. Section 04 05 16, MASONRY GROUT.
 3. Section 04 20 00, UNIT MASONRY.
 4. Section 04 72 00, CAST STONE MASONRY.
- B. Mortar Color: To match existing columbarium mortar.

1.3 TESTING LABORATORY-CONTRACTOR RETAINED

- A. Engage a commercial testing laboratory approved by COTR to perform tests specified below and in 01 45 29, TESTING LABORATORY SERVICES.
- B. Submit information regarding testing laboratory's facilities and qualifications of technical personnel to COTR.

1.4 TESTS

- A. Test materials proposed for use for compliance with specifications in accordance with test methods contained in referenced specifications and as follows:
- B. Mortar:
1. Test for compressive strength and water retention; ASTM C270.
 2. Mortar compressive strengths 28 days as follows:
Type S: Minimum 1800 psi at 28 days.
Type N: Minimum 750 psi at 28 days.
- C. Cement:
1. Test for water soluble alkali (nonstaining) when nonstaining cement is specified.
 2. Nonstaining cement shall contain not more than 0.03 percent water soluble alkali.
- D. Sand: Test for deleterious substances, organic impurities, soundness and grading.

1.5 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Mix design.
- C. Certificates:
 - 1. Testing laboratory's facilities and qualifications of its technical personnel.
 - 2. Indicating that following items meet specifications:
 - a. Aggregates.
 - b. Portland cement.
 - c. Masonry cement.
 - d. Mortar cement.
 - e. Hydrated lime.
 - f. Color admixture.
- D. Laboratory Test Reports:
 - 1. Mortar, each type.
 - 2. Admixtures.
- E. Manufacturer's Literature and Data:
 - 1. Cement, each kind.
 - 2. Hydrated lime.
 - 3. Admixtures.
 - 4. Liquid acrylic resin.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver masonry materials in original sealed containers marked with name of manufacturer and identification of contents.
- B. Store masonry materials under waterproof covers on planking clear of ground, and protect damage from handling, dirt, stain, water and wind.

1.7 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of specification to extent referenced. Publications are referenced in text by basic designation only. Use the latest edition of the referenced publication.
- B. American Society for Testing and Materials (ASTM):
 - C40 Organic Impurities in Fine Aggregates for Concrete
 - C91 Masonry Cement
 - C109 Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-MM Cube Specimens)
 - C144 Aggregate for Masonry Mortar
 - C150 Portland Cement
 - C207 Hydrated Lime for Masonry Purposes

C270.....	Mortar for Unit Masonry
C595.....	Blended Hydraulic Cement
C780.....	Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
C979.....	Pigments for Integrally Colored Concrete
C1329.....	Mortar Cement

PART 2 - PRODUCTS

2.1 HYDRATED LIME

- A. ASTM C207, Type S.

2.2 QUICKLIME

- A. ASTM C5.

2.3 LIME PUTTY

- A. Made from hydrated lime or quicklime
 1. If made from quicklime, other than processed pulverized quicklime, slake lime and then screen through a No. 16 mesh sieve. Before using, store and protect slaked and screened lime putty for not less than 10 days.
 2. Processed pulverized quicklime shall be slaked for not less than 48 hours, and shall be cool when used.
 3. Lime putty prepared from hydrated lime may be used immediately after mixing.
 4. Lime putty prepared from quicklime or pulverized quicklime shall have a plasticity figure, after slaking and screening, of not less than 200, and shall weigh not less than 83 lbs. per cubic foot. Lime putty prepared from hydrated lime shall conform to ASTM C 207, Type S.

2.4 AGGREGATE FOR MASONRY MORTAR

- A. ASTM C144 and as follows:
 1. Light colored sand for mortar for laying face brick.
- B. Test sand for color value in accordance with ASTM C40. Sand producing color darker than specified standard is unacceptable.

2.5 MORTAR CEMENT

- A. ASTM C1329, Type S.
 1. 28 day compressive strength of not less than 1800 psi.
 2. Conforming to IBC Section 2103.

2.6 PORTLAND CEMENT

- A. ASTM C150, Type I or II.

- B. Use white Portland cement wherever white mortar is specified.

2.7 WATER

- A. Potable, free of substances that are detrimental to mortar, masonry, and metal.

2.8 MASONRY MORTAR

- A. Conform to ASTM C270.
- B. Mortar mix shall be proportioned by volume; one part portland cement, not less than 1/4 part nor more than 1/2 part lime putty, and sand totaling not less than 2-1/4 nor more than 3 times sum of volumes of cement and lime used.
 - 1. Total clay content shall not exceed 2% of sand content or 6% of cement content.
- C. Admixtures:
 - 1. Do not use mortar admixtures, except color admixtures if approved by COTR.
 - 2. Submit laboratory test report showing effect of proposed admixture on strength, water retention, and water repellency of mortar.
 - 3. Do not use antifreeze compounds.
- D. Colored Mortar:
 - 1. Maintain uniform mortar color for exposed Work throughout.
 - 2. Match mortar color in approved sample or mock-up.
 - 3. Color of mortar for exposed work in alteration work to match color of existing mortar.
- E. Color Admixtures:
 - 1. Proportion as specified by manufacturer.
 - 2. Color to match existing.

2.9 COLOR ADMIXTURE

- A. Pigments: ASTM C979.
- B. Use mineral pigments only. Organic pigments are not acceptable.
- C. Pigments inert, stable to atmospheric conditions, nonfading, alkali resistant and water insoluble.

PART 3 - EXECUTION

3.1 MIXING

- A. Accurately measure materials in suitably calibrated devices; shovel measurements are not acceptable. Each 94lb. sack of portland cement will be considered as 1 cubic foot.
- B. Mix in a mechanically operated mortar mixer.

1. Mix mortar for at least two minutes but not more than five minutes. Then add lime putty and continue mixing to secure uniform mass, but in no case fewer than 10 minutes.
 2. Use mixers of at least 1 sack capacity; batches requiring fractional sacks will not be permitted unless cement is weighed for each batch.
- C. Measure ingredients by volume. Measure by the use of a container of known capacity.
- D. Mix water with dry ingredients in sufficient amount to provide a workable mixture which will adhere to vertical surfaces of masonry units.
- E. Mortar that has stiffened because of loss of water through evaporations:
1. Re-tempered by adding water to restore to proper consistency and workability.
 2. Discard mortar that has reached its initial set or has not been used within 30 minutes.

3.2 DEFECTIVE MORTAR

- A. Should the strength of mortar fall below that specified, remainder of Work shall be adjusted to reach required strength. Work in place representing inferior mortar and indicating a strength less than the minimum specified shall be tested by taking and testing core samples. Number and location of cores shall be determined by COTR.
- B. Should compression tests of cores fail to meet required strength, masonry shall be deemed to be defective and shall be removed and replaced at no cost to VA.
- C. Costs relative to taking and testing of core samples shall be paid by Contractor. Cost of patching core holes shall be borne by Contractor.

END OF SECTION

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SECTION 04 05 16

MASONRY GROUT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The Work of this Section specifies grout materials and mixes.

1.2 RELATED WORK:

- A. Grout used in Section:
 - 1. Section 03 45 00, PRECAST ARCHITECTURAL CONCRETE.
 - 2. Section 04 20 00, UNIT MASONRY.
 - 3. Section 04 43 00 NATURAL STONE VENEER
- B. Grout Color: To match existing. Provide sample.

1.3 TESTS:

- A. Test grout and materials specified herein and in 01 45 29, TESTING LABORATORY SERVICES.
- B. Certified test reports.
- C. Identify materials by type, brand name and manufacturer or by origin.
- D. Do not use materials until laboratory test reports are approved by COTR.
- E. After tests have been made and materials approved, do not change without additional test and approval of COTR.
- F. Testing:
 - 1. Test materials proposed for use for compliance with specifications in accordance with test methods contained in referenced specifications and as follows:
 - 2. Grout:
 - a. Test for compressive strength; ASTM C1019.
 - b. Grout compressive strength of 2000 psi at 28 days.
 - 3. Cement:
 - a. Test for water soluble alkali (nonstaining) when nonstaining cement is specified.
 - b. Nonstaining cement shall contain not more than 0.03 percent water soluble alkali.
 - 4. Sand: Test for deleterious substances, organic impurities, soundness and grading.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Certificates:
 - 1. Indicating that following items meet specifications:
 - a. Aggregates.
 - b. Portland cement.
 - c. Masonry cement.
 - d. Grout.
 - e. Hydrated lime.
 - f. Color admixture.
- C. Laboratory Test Reports:
 - 1. Grout, each type.
 - 2. Admixtures.
- D. Manufacturer's Literature and Data:
 - 1. Cement, each kind.
 - 2. Hydrated lime.
 - 3. Admixtures.
 - 4. Liquid acrylic resin.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING:

- A. Deliver masonry materials in original sealed containers marked with name of manufacturer and identification of contents.
- B. Store masonry materials under waterproof covers on planking clear of ground, and protect damage from handling, dirt, stain, water and wind.

1.6 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of specification to extent referenced. Publications are referenced in text by basic designation only. Use the latest edition of the referenced publication.
- B. American Society for Testing and Materials (ASTM):
 - C40 Organic Impurities in Fine Aggregates for Concrete
 - C150 Portland Cement
 - C207 Hydrated Lime for Masonry Purposes
 - C404 Aggregate for Masonry Grout
 - C476 Grout for Masonry
 - C595 Blended Hydraulic Cement
 - C979 Pigments for Integrally Colored Concrete

PART 2 - PRODUCTS

2.1 HYDRATED LIME:

A. ASTM C207, Type S.

2.2 QUICKLIME

A. ASTM C5.

2.3 LIME PUTTY

A. Made from hydrated lime or quicklime

1. If made from quicklime, other than processed pulverized quicklime, slake lime and then screen through a No. 16 mesh sieve. Before using, store and protect slaked and screened lime putty for not less than 10 days.
2. Processed pulverized quicklime shall be slaked for not less than 48 hours, and shall be cool when used.
3. Lime putty prepared from hydrated lime may be used immediately after mixing.
4. Lime putty prepared from quicklime or pulverized quicklime shall have a plasticity figure, after slaking and screening, of not less than 200, and shall weigh not less than 83 lbs. per cubic foot. Lime putty prepared from hydrated lime shall conform to ASTM C 207, Type S.

2.4 AGGREGATE FOR MASONRY GROUT:

A. ASTM C404, Size 8.

2.5 PORTLAND CEMENT:

A. ASTM C150, Type I or II, low alkali, natural gray.

2.6 WATER:

A. Potable, free of substances that are detrimental to grout, masonry, and metal.

2.7 GROUT:

A. Conform to ASTM C476 except as specified.

B. Grout shall have a 28-day compressive strength of not less than 2000 psi. Proportion by volume, and with sufficient water to produce consistency for pouring without segregation so that grout will flow into masonry joints. Grout shall conform to IBC Section 2103:

1. Fine Grout:
 - a. Portland cement or blended hydraulic cement: one part.
 - b. Lime putty: 0 to 1/10 part.
 - c. Fine aggregate (sand): 3 parts.
 - d. Use for grout spaces less than 3" wide.
2. Coarse Grout:
 - a. Portland cement or blended hydraulic cement: one part.
 - b. Lime putty: 0 to 1/10 part.
 - c. Fine aggregate (sand): 3 parts.

- d. Coarse aggregate (pea gravel): 1 to 2 times sum of volumes of cement and lime used. Not more than 5% of the coarse aggregate shall pass the No. 8 sieve and 100% shall pass the 3/8" sieve.
- e. Use for grout spaces greater than 3" wide.
- 3. Sum of volumes of fine and coarse aggregates: Do not exceed four times sum of volumes of cement and lime used.
- 4. Add Sika Grout Aid admixture to grout at the rate of 1 pound per 100 pounds cementitious material.

2.8 COLOR ADMIXTURE:

- A. Pigments: ASTM C979.
- B. Use mineral pigments only. Organic pigments are not acceptable.
- C. Pigments inert, stable to atmospheric conditions, nonfading, alkali resistant and water insoluble.

PART 3 - EXECUTION

3.1 MIXING

- A. Accurately measure materials in suitably calibrated devices; shovel measurements are not acceptable. Each 94lb. sack of portland cement will be considered as 1 cubic foot.
 - 1. Measure ingredients by volume. Measure by the use of a container of known capacity.
- B. Mix in a mechanically operated grout mixer.
 - 1. Mix grout for at least five minutes. Then add lime putty and continue mixing to secure uniform mass, but in no case fewer than 10 minutes.
 - 2. Use mixers of at least 1 sack capacity; batches requiring fractional sacks will not be permitted unless cement is weighed for each batch.
 - 3. Mix water with grout dry ingredients in sufficient amount to bring grout mixture to a pouring consistency.

3.2 DEFECTIVE GROUT

- A. Should the strength of grout fall below that specified, remainder of Work shall be adjusted to reach required strength. Work in place representing inferior grout and indicating a strength less than the minimum specified shall be tested by taking and testing core samples. Number and location of cores shall be determined by COTR.
- B. Should compression tests of cores fail to meet required strength, masonry shall be deemed to be defective and shall be removed and replaced at no cost to VA.
- C. Costs relative to taking and testing of core samples shall be paid by Contractor. Cost of patching core holes shall be borne by Contractor.

END OF SECTION

SECTION 04 20 00

UNIT MASONRY

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The Work of this Section specifies requirements for construction of masonry unit pier.

1.2 RELATED WORK

- A. Reinforcing Steel: Section 03 21 00.
- B. Cast in Place Concrete: Section 03 30 00.
- C. Mortars and grouts: Section 04 05 13, MASONRY MORTAR, Section 04 05 16, MASONRY GROUT.
- D. Natural Stone Veneer: Section 04 43 00.
- E. Sealants and sealant installation: Section 07 92 00, JOINT SEALANTS.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- B. Samples:
 - 1. Concrete masonry units, when exposed in finish Work.
 - 2. Anchors, and ties, one each and joint reinforcing 12 inches long.
- C. Shop Drawings:
 - 1. Special masonry shapes.
 - 2. Drawings, showing reinforcement and applicable dimensions.
 - 3. Shop Drawings: Submit shop drawings for fabrication, bending, and placement of reinforcing bars. Comply with ACI 315.
- D. Certificates:
 - 1. Certificates signed by manufacturer, including name and address of Contractor, project location, and the quantity, and date or dates of shipment of delivery to which certificate applies.
 - 2. Indicating that the following items meet specification requirements:
 - a. Solid and load-bearing concrete masonry units.
 - 3. Testing laboratories facilities and qualifications of its principals and key personnel to perform tests specified.
- E. Manufacturer's Literature and Data:
 - 1. Anchors, ties, and reinforcement.
 - 2. Shear keys.

3. Reinforcing bars.

1.4 PRODUCT HANDLING

- A. Scaffolding, runways and ladders required for work under this Section shall be provided by masonry contractor, and shall be heavy trades type substantially built and in compliance with State labor laws, safety codes and other regulatory agencies as applicable to this project.
- B. Environmental Requirements: Install concrete unit masonry when temperature in area surrounding work is 40° F or above. Maintain temperature of work above 40° F for at least 48 hours after installation. Grout shall not be placed when air temperatures fall below 20° F.
- C. Store masonry units off the ground in a dry location, covered and protected from absorbing moisture.

1.5 WARRANTY

- A. Warranty exterior masonry walls against moisture leaks and subject to terms of "Warranty of Construction", FAR clause 52.246-21, except that warranty period shall be five years.

1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only. Use the latest edition of the referenced publication.
- B. American Society for Testing and Materials (ASTM):
 - A615 Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 - A675 Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties
 - A951 Steel Wire for Masonry Joint Reinforcement.
 - C90 Load-Bearing Concrete Masonry Units
 - C476 Standard Specification for Grout for Masonry
 - C612 Mineral Fiber Block and Board Thermal Insulation
 - C744 Prefaced Concrete and Calcium Silicate Masonry Units.
 - D1056 Flexible Cellular Materials - Sponge or Expanded Rubber
 - D3574 Flexible Cellular Materials-Slab, Bonded, and Molded Urethane Foams
 - F1667 Fasteners: Nails, Spikes and Staples
- C. Masonry Industry Council:
Hot and Cold Weather Masonry Construction Manual, 1999.
- D. American Welding Society (AWS):

D1.4 Structural Welding Code – Reinforcing Steel.

- E. Masonry Standards Joint Committee; Specifications for Masonry Structures (ACI 530.1-08/ASCE 6-05/TMS 602-05) (MSJC).
- F. American Concrete Institute (ACI)
ACI 315 Details and Detailing of Concrete Reinforcement

PART 2 - PRODUCTS

2.1 CONCRETE MASONRY UNITS

- A. Hollow Load-Bearing Concrete Masonry Units: ASTM C90 and IBC Section 2103.1.
 - 1. Unit Weight: lightweight.
 - 2. Sizes: 8" wide x 8" high x 16" long unless specified otherwise.
 - 3. Maximum lineal shrinkage from saturated to oven dry condition of not more than 0.065 percent.
 - 4. Twenty-eight day compressive strength of 1000 psi on gross area and 1900 psi on net area.
 - 5. Moisture controlled units.
 - 6. Provide bond beam units, open end units and other special units as indicated. Use open end units at cells containing vertical reinforcement wherever possible.

2.2 ANCHORS, TIES, AND REINFORCEMENT

- A. Steel Reinforcing Bars: ASTM A615M, deformed bars, grade as shown. Where No. 2 bars are shown, provide plain, round, carbon steel bars, ASTM A675, Grade 80.
- B. Joint Reinforcement:
 - 1. Form from wire complying with ASTM A951.
 - 2. Galvanized after fabrication.
 - 3. Width of joint reinforcement 0.16 inches less than nominal width of masonry wall or partition.
 - 4. Cross wires welded to longitudinal wires.
 - 5. Joint reinforcement at least 10 feet in length.
 - 6. Joint reinforcement in rolls is not acceptable.
 - 7. Joint reinforcement that is crimped to form drip is not acceptable.
 - 8. Maximum spacing of cross wires 16 inch to longitudinal wires.
 - 9. Ladder Design:
 - a. Longitudinal wires deformed 0.16 inch diameter wire.
 - b. Cross wires 0.10 inch diameter.
 - 10. Trussed Design:
 - a. Longitudinal and cross wires not less than 0.16 inch nominal diameter.
 - b. Longitudinal wires deformed.

- C. Anchor Bolts: All anchor bolts cast in masonry shall be headed bolts with cut threads conforming to ASTM A307 or ASTM A36 or ASTM A572.50 as indicated on drawings.
- D. Expansion Anchors: All expansion bolts installed in masonry shall be Hilti Kwik Bolt 3 expansion bolts as manufactured by Hilti Inc. See Structural Drawings for installation requirements and tension testing requirements as applicable. See Drawings for special head requirements as needed. Substitution of other brands or anchors shall proceed only after written approval from the COTR has been obtained.
- E. Adjustable Veneer Anchor for Frame Walls:
 - 1. Two piece, adjustable anchor and tie.
 - 2. Anchor and tie may be either type; use only one type throughout.
 - 3. Loop Type:
 - a. Anchor: Screw-on galvanized steel anchor strap 0.11 inch by 3/4 inch wide by 9 inches long, with 0.35 inch offset and 4 inch adjustment. Provide 0.20 inch hole at each end for fasteners.
 - b. Ties: Triangular tie, fabricated of 0.20 inch diameter galvanized cold drawn steel wire. Ties long enough to engage the anchor and be embedded not less than 2 inches into the bed joint of the masonry veneer.
 - 4. Angle Type:
 - a. Anchor: Minimum 16 gage thick galvanized steel angle shaped anchor strap. Provide hole in vertical leg for fastener. Provide hole near end of outstanding leg to suit upstanding portion of tie.
- F. Corrugated Wall Tie:
 - 1. Form from 0.0598 inch thick corrugated, galvanized steel 1-1/4 inches wide by lengths so as to extend at least 4 inches into joints of new masonry plus 1-1/2 inch turn-up.
 - 2. Provide 3/16 inch hole in turn-up for fastener attachment.

2.3 JOINTS

- A. Thickness and depth to fill the joint as specified.
- B. All joints shall be 3/8" thick joints for concrete block, Tool exposed interior and exterior joints and concealed exterior joints to produce a dense slightly concave surface that is well bonded to unit at edges. Tool joints behind room base, switches, and outlet plates to produce a smooth dense joint flush with the face of adjacent masonry units, where occurring on the job. Cut joints flush on concealed interior surfaces and surfaces to be plastered.

2.4 ACCESSORIES

- A. Sealer: Contractor shall provide and install minimum two coats, Thoroseal masonry sealer at all CMU walls. Thoroseal product shall meet all state vapor requirements. Sealer shall be clear and non-gloss product.
- B. Weep Hole Wicks: Glass fiber ropes, 3/8 inch minimum diameter, 12 inches long.

- C. Cavity Drain Material: Shall be a recycled polyester/polyethylene mesh trapezoidal shaped to maintain cavity air flow and drainage while suspending mortar droppings at unequal heights.
- D. Masonry Cleaner:
 - 1. Detergent type cleaner selected for each type masonry used.
 - 2. Acid cleaners are not acceptable.
 - 3. Use soapless type specially prepared for cleaning concrete masonry as appropriate.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive masonry and verify following:
 - 1. That foundation surface is level to permit bed joint with range of 1/4 to 3/4 inch.
 - 2. That edge is true to line to permit projection of masonry to less than 1/4 inch.
 - 3. That projecting dowels are free from loose scale, dirt, concrete, or other bond inhibiting substances and properly located.
- B. Do not begin work before unsatisfactory conditions have been corrected.

3.2 JOB CONDITIONS

- A. Protection:
 - 1. Cover tops of walls with nonstaining waterproof covering, when Work is not in progress. Secure to prevent wind blow off.
 - 2. On new Work protect base of wall from mud, dirt, mortar droppings, and other materials that will stain face, until final landscaping or other site Work is completed.
- B. Cold Weather Protection:
 - 1. Masonry may be laid in freezing weather when methods of protection are utilized.
 - 2. Comply with MSJC and "Hot and Cold Weather Masonry Construction Manual".
- C. Clean concrete surfaces to receive masonry. Remove laitance or other foreign material lodged in surfaces by sandblasting or other means as required.
- D. Ensure masonry units are clean and free from dust, dirt, or other foreign materials before laying.
- E. Establish lines, levels, and coursing. Protect from disturbances.
- F. Provide temporary bracing during erection of masonry work. Maintain in place until masonry has set to provide permanent bracing.

3.3 CONSTRUCTION TOLERANCES

- A. Erect masonry in accordance with IBC Section 2104.1.2.
- B. Lay masonry units plumb, level and true to line within the tolerances as per MSJC requirements and as follows:
- C. Maximum variation from plumb:
 - 1. In 10 feet - 1/4 inch.
 - 2. In 20 feet - 3/8 inch.
- D. Maximum variation from level:
 - 1. In any bay or up to 20 feet - 1/4 inch.
 - 2. In 40 feet or more - 1/2 inch.
- E. Maximum variation from linear building lines:
 - 1. In any bay or up to 20 feet - 1/2 inch.
 - 2. In 40 feet or more - 3/4 inch.
- F. Maximum variation in cross-sectional dimensions of columns and thickness of walls from dimensions shown:
 - 1. Minus 1/4 inch.
 - 2. Plus 1/2 inch.
- G. Maximum variation in prepared opening dimensions:
 - 1. Accurate to minus 0 inch.
 - 2. Plus 1/4 inch.

3.4 INSTALLATION GENERAL

- A. Do not install cracked, broken, or chipped masonry units. Lay only dry concrete masonry units.
- B. Keep finish Work free from mortar smears or spatters, and leave neat and clean.
- C. Anchor masonry as specified in Paragraph, ANCHORAGE.
- D. Lay masonry in full bed of mortar, properly jointed with other work. Buttering corners of joints, and deep or excessive furrowing of mortar joints are not permitted.
 - 1. Block Cap: Lay with full mortar coverage on horizontal and vertical joints.
 - 2. Install grout cap where and as indicated.
- E. Fully bond intersections and external and internal corners.
- F. Do not shift or tap masonry units after mortar has taken initial set. Where adjustment must be made, remove mortar and replace.
- G. Remove excess mortar.
- H. Perform job-site cutting with proper tools to provide straight unchipped edges. Take care to prevent breaking masonry unit corners or edges.

- I. Step back unfinished work for joining with new work. Do not use toothing.
- J. Wall Openings:
 - 1. Fill hollow metal frames built into masonry walls and partitions solid with mortar as laying of masonry progresses.
 - 2. If items are not available when walls are built, prepare openings for subsequent installation.
- K. Tooling Joints:
 - 1. Do not tool until mortar has stiffened enough to retain thumb print when thumb is pressed against mortar.
 - 2. Tool while mortar is soft enough to be compressed into joints and not raked out.
 - 3. Finish joints in exterior face masonry Work with a jointing tool, and provide smooth, water-tight concave joint unless specified otherwise.
 - 4. Tool Exposed interior joints in finish Work concave unless specified otherwise.
- L. Lintels:
 - 1. Lintels are not required for openings less than 3 feet 4 inches wide that have hollow metal frames.
 - 2. Openings 2 feet 0 inches wide to 5 feet 4 inches wide with no structural steel lintel or frames, require a lintel formed of concrete masonry lintel or bond beam units filled with grout per ASTM C476 and reinforced with 1-#5 rod top and bottom for each 4 inches of nominal thickness unless shown otherwise.
 - 3. Use steel lintels, for openings over 5 feet 4 inches wide unless shown otherwise.
 - 4. Length for minimum bearing of 4 inches at ends.
- M. Before connecting new masonry with previously laid, remove loosened masonry or mortar, and clean and wet Work in place as specified under wetting.
- N. Wetting and Wetting Test:
 - 1. Do not wet concrete masonry units before laying.

3.5 ANCHORAGE

- A. Veneer to Frame or Masonry Walls:
 - 1. Use adjustable veneer anchors.
 - 2. Fasten anchor to stud through sheathing with self drilling and tapping screw, one at each end of loop type anchor. In masonry backup stagger ties in alternate courses.
 - 3. Space anchors not more than 16 inches on center vertically at each stud or 24 inches maximum horizontally.

3.6 REINFORCEMENT

- A. Place reinforcement in accordance with ACI 315, to a tolerance of + ½ inch from specified location.

- B. Joint Reinforcement:
 - 1. Use as joint reinforcement in CMU wythe, cavity walls, and single wythe concrete masonry unit walls or partitions.
- C. Steel Reinforcing Bars:
 - 1. Install in cells of hollow masonry units where required for vertical reinforcement and in bond beam units for lintels and bond beam horizontal reinforcement. Install in wall cavities of reinforced masonry walls where shown.

3.7 BUILDING EXPANSION AND SEISMIC JOINTS

- A. Keep joint free of mortar. Remove mortar and other debris.
- B. Install non-combustible, compressible type joint filler to fill space completely except where sealant is shown on joints in exposed finish work.
- C. Where joints are on exposed faces, provide depth for backer rod and sealant as specified in Section 07 92 00, JOINT SEALANTS, unless shown otherwise.

3.8 CONCRETE MASONRY UNITS

- A. Kind and Users:
 - 1. Provide special concrete masonry shapes as required, including bond beam units and corner units. Use solid concrete masonry units, where full units cannot be used, or where needed for anchorage of accessories.
 - 2. Provide solid load-bearing concrete masonry units or grout the cell of hollow units at jambs of openings in walls, where structural members impose loads directly on concrete masonry, and where shown.
- B. Laying:
 - 1. Lay concrete masonry units with 3/8 inch joints, with a bond overlap of not less than 1/4 of the unit length.
 - 2. Do not wet concrete masonry units before laying.
 - 3. Bond external corners of partitions by overlapping alternate courses.
 - 4. Lay first course in a full mortar bed.
 - 5. Set anchorage items as Work progress.
 - 6. Where ends of anchors, bolts, and other embedded items, project into voids of units, completely fill such voids with mortar or grout.
 - 7. Provide a 1/4 inch open joint for caulking between exterior walls, concrete Work, and abutting masonry partitions.
 - 8. Lay concrete masonry units with full face shell mortar beds and fill head joint beds for depth equivalent to face shell thickness.
 - 9. Lay concrete masonry units so that cores of units, that are to be filled with grout, are vertically continuous with joints of cross webs of such cores completely filled with mortar.
 - 10. Do not wedge the masonry against the steel reinforcing. Minimum 1/2 inch clear distance between reinforcing and masonry units.
 - 11. Hold vertical steel reinforcement in place by centering clips, caging devices, tie wire, or other approved methods, vertically at spacings noted.

12. Grout cells of concrete masonry units, containing the reinforcing bars, solid as specified under grouting.

3.9 GROUTING

- A. General Requirements:
 1. All cells shall be grouted solid.
 2. Use low lift or high lift grouting at Contractor's option.
 3. Use grout pump, hopper or bucket to place grout.
 4. Place grout in final position within 1 1/2 hours after introduction of mixing water.
 5. Place grout and rod with a 3/4 inch flexible cable vibrator sufficiently to case it to flow into all voids between the cells and around the reinforcing steel. Slushing with mortar will not be permitted.
- B. Preparation:
 1. Clean grout space of mortar droppings before placing grout.
 2. Close cleanouts.
- C. Placing:
 1. Consolidate each lift of grout after free water has disappeared but before plasticity is lost.
 2. Interruptions:
 - a. When grouting must be stopped for more than an hour, top off grout 1-1/2 inch below top of last masonry course.
- D. Low Lift Grouting:
 1. Do not lay units higher than 48 inches before grouting.
 2. If mortar has been allowed to set prior to grouting, remove all fins protruding more than 1/2 inch into grout space.
 3. Conform to requirements of IBC Section 2104.6.
 4. Consolidate each lift twice. Once while placing grout and once more after initial absorption of water but before set.
- E. High Lift Grouting:
 1. Conform to requirements of IBC Section 2104.6.
 2. Lay up walls, subject to maximum height limitations of IBC Table 21-C.
 3. Provide clean out holes at the bottom of every pour in cells containing vertical reinforcement. Construct clean out courses with open bottom bond beam units inverted to permit cleaning of all cells by flushing. Cleanouts shall be not less than 3x4inch openings cut from one face shell. Do not plug clean out holes until masonry work, reinforcement, and final cleaning of the grout spaces have been completed and inspected.
 4. Clean mortar droppings from the bottom of the grout space and from reinforcing steel. Remove mortar fins protruding more than 1/2 inch into the grout space by dislodging the projections with a rod or stick as the work progresses or by washing the grout space at least twice a day during erection using a high pressure stream of water.
 5. Do not place grout in hollow unit masonry until mortar joints have set for at least 72 hours and clean out plugs have cured 48 hours.

6. Place grout in lifts not to exceed 4 feet in height, with a waiting period between lifts, dependent on weather and absorption rate of the masonry, in order to place the succeeding lift after the preceding lift becomes plastic but prior to initial set. The first lift shall be consolidated using mechanical vibrators. After the required waiting period, place the second lift and consolidate with the vibrator, reconsolidating the lift below to a depth of 12 to 18 inches. Repeat the waiting, placing and consolidating process until the top of the grout pour is reached. Reconsolidate the top lift after the required waiting period. The high lift grouting of any section of wall between lateral flow barriers shall be completed to the top of a pour in one working day unless a new series of clean out holes is established and the resulting horizontal construction joint cleaned.

3.10 PLACING REINFORCEMENT

- A. General: Clean reinforcement of loose rust, mill scale, earth, ice or other materials which will reduce bond to mortar or grout. Do not use reinforcement bars with kinks or bends not shown on the Construction Documents or final shop drawings, or bars with reduced cross-section due to excessive rusting or other causes.
- B. Position reinforcement accurately at the spacing indicated. Support and secure vertical bars against displacement. Horizontal reinforcement may be placed as the masonry Work progresses. Where vertical bars are shown in close proximity, provide a clear distance between bars of not less than the nominal bar diameter or 1 inch, whichever is greater.
- C. Splice reinforcement bars where shown; do not splice at other places unless accepted by the COTR. Provide lapped splices, unless otherwise indicated. In splicing vertical bars or attaching to dowels, lap ends, place in contact and wire tie.
- D. Provide not less than minimum lap as indicated on shop drawings, or if not indicated, as required by governing code.
- E. Embed metal ties in mortar joints as Work progresses, with a minimum mortar cover of 5/8 inch on exterior face of walls and 1/2 inch at other locations.
- F. Embed prefabricated horizontal joint reinforcement as the Work progresses, with a minimum cover of 5/8 inch on exterior face of walls and 1/2 inch at other locations. Lap joint reinforcement not less than 6 inches at ends. Use prefabricated "L" and "T" sections to provide continuity at corners and intersections. Cut and bend joint reinforcement as recommended by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.
- G. Anchoring: Anchor reinforced masonry Work to supporting structure as indicated.

3.11 CLEANING AND REPAIR

- A. General:
 - 1. Clean exposed masonry surfaces on completion.
 - 2. Protect adjoining construction materials and landscaping during cleaning operations.
 - 3. Cut out defective exposed new joints to depth of approximately 3/4 inch and repoint.
 - 4. Remove mortar droppings and other foreign substances from wall surfaces.
- B. Concrete Masonry Units:
 - 1. Immediately following setting, brush exposed surfaces free of mortar or other foreign matter.
 - 2. Allow mud to dry before brushing.

3.12 SEALER

- A. Contractor shall install sealer as directed by the manufacturer. Coverage and installation rates shall be as per manufacturer's recommendations. Install sealer in minimum two coats at the rates required.

3.13 DEFECTIVE MASONRY

- A. Materials or workmanship not conforming to appearance or strength specified, will be deemed defective and shall be removed and replaced at no cost to VA.
- B. Defective mortar and grout, as defined under Section 04 05 13 MORTAR and 04 05 16 GROUT shall constitute defective masonry.

END OF SECTION

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SECTION 04 43 00

NATURAL STONE VENEER

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies requirements for construction of natural stone veneer.

1.2 RELATED WORK

- A. Mortars and grouts: Section 04 05 13, MASONRY MORTARING, Section 04 05 16, MASONRY GROUTING.
- B. Steel lintels and shelf angles: Section 05 50 00, METAL FABRICATIONS.
- C. Sealants and sealant installation: Section 07 92 00, JOINT SEALANTS.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- B. Samples:
 - 1. Stone Veneer, sample 8 inches by 16 inches, showing full color range and texture of stone, bond, and proposed mortar joints.
- C. Certificates:
 - 1. Certificates signed by manufacturer, including name and address of contractor, project location, and the quantity, and date or dates of shipment of delivery to which certificate applies.
 - 2. Indicating that the following items meet specification requirements:
 - a. Stone veneer.
- D. Manufacturer's Literature and Data:
 - 1. Anchors, ties, and reinforcement.
 - 2. Reinforcing bars.

1.4 SAMPLE PANEL

- A. Before starting masonry, lay up a sample panel
 - 1. Use stone units from random pallets of units delivered on site.
 - 2. Include reinforcing, ties, and anchors.
 - 3. Provide a 4 feet x 5 feet panel
- B. Use sample panels approved by COTR for standard of workmanship of new masonry work.
- C. Use sample panel to test cleaning methods.

1.5 WARRANTY

- A. Warrant exterior masonry walls against moisture leaks and subject to terms of "Warranty of Construction", FAR clause 52.246-21, except that warranty period shall be five years.

1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - A82/A82M-07 Standard Specification for Steel Wire, for Concrete Reinforcement
 - A153/A153M-09 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
 - A951-06 Steel Wire for Masonry Joint Reinforcement
 - C119-08 Standard Terminology Relating to Dimension Stone
 - C568-08a Standard Specifications for Limestone Dimension Stone
 - C615-03 Standard Specification for Granite Dimension Stone
 - C616-08 Standard Specification for Quartz-Based Dimension Stone
 - C1242-05 Standard Guide for Selection, Design, and Installation of Dimension Stone Anchoring Systems
 - C1353-09 Standard Test Method for Abrasion Resistance of Dimension Stone Subjected to Foot Traffic Using a Rotary Platform, Double-Head Abraser
 - C1515-01 Standard Guide to Cleaning of Exterior Dimension Stone, Vertical and Horizontal Surfaces, New or Existing
 - C1528-09 Standard Guide for Selection of Dimension Stone for Exterior Use
 - D1056-07 Standard Specification for Flexible Cellular Materials – Sponge Expanded Rubber
 - D7089-06 Standard Practice for Determination of the Effectiveness of Anti-Graffiti Coating for Use on Concrete, Masonry, and Natural Stone Surfaces by Pressure Washing
- C. Masonry Industry Council:
 - All Weather Masonry Construction Manual, 2000.
- D. Federal Specifications (FS):
 - FF-S-107C-00 Screws, Tapping and Drive
- E. International Masonry Industry All Weather Council (IMIAC): Recommended Practices and Guide Specification for Cold Weather Masonry Construction

PART 2 - PRODUCTS

2.1 ACCEPTABLE STONE PRODUCTS

- A. Limestone Veneer: Meet ASTM C568, Classification: III High-Density.
 - 1. Face Size: As indicated
 - 2. Color Range, finish, manufacturer/producer to match existing.

2.2 REINFORCEMENT AND ANCHORAGES

- A. Materials: Provide ties and anchors specified in subsequent paragraphs that are made from materials that comply paragraphs below, unless otherwise indicated.
 - 1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A82; with ASTM A153/153M, Class B-2 coating.
- B. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but at least 16mm (5/8 inch) cover on outside face. Outer ends of wires are bent 90 degrees and extend 50 mm (2 inches) parallel to face of veneer.
- C. Individual Wire Ties: Rectangular units with closed ends and not less than 100 mm (4 inches).
 - 1. Where withes do not align or are of different materials, use adjustable ties with pintle-and-eye connections having a maximum adjustment of 32 mm (1-1/4 inches).
 - 2. Wire: Fabricate from 4.8 mm (3/16 inch) diameter, hot-dip galvanized steel wire. Mill-galvanized wire ties may be used in interior walls, unless otherwise indicated.
 - 3. Acceptable Product: Heckman Building Products Inc.; No. 262.
- D. Adjustable Masonry-Veneer Anchors
 - 1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:
 - a. Structural Performance Characteristics: Capable of withstanding a 445 N (100 lbf) load in both tension and compression without deforming or developing play in excess of 1.3 mm (0.05 inch).
 - 2. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie and a metal anchor section.
 - a. Anchor Section: Zinc-allow barrel section with flanged head with eye and corrosion-resistant, self-drilling screw. Eye designed to receive wire tie and to serve as head for drilling fastener into framing. Barrel length to suit sheathing thickness, allowing screw to seat directly against framing with flanged head covering hole in sheathing.
 - b. Wire Ties: Triangular-, rectangular-, or T-shaped wire ties fabricated from 4.8 mm (0.188 inch) diameter, hot-dip galvanized steel wire.

- c. Acceptable Product: Heckmann Building Products, Inc.; No. 75 Pos-I-Tie.

2.3 ACCESSORIES

- A. Joint Sealant: Refer to Section 07 92 00.
- B. Nailing Strips: Western softwood, preservative treated, sized to masonry joints.
- C. Weep Holes: Leave-out of full head mortar joints.
- D. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
 - 1. Strips, full-depth of cavity and 250 mm (10 inches) wide, with dovetail shaped notches 175 mm (7 inches) deep that prevent mesh from being clogged with mortar droppings.
- E. Mortar: Refer to Section 04 05 13.
- F. Expansion Joint Fillers: ASTM D1056 Class RE-11.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Verify items provided by other Sections of work are properly sized and located.
- C. Verify that built-in items are in proper location, and ready for roughing into masonry work.
- D. Beginning of installation means installer accepts existing conditions.

3.2 PREPARATION

- A. Verify items provided by other Sections of work are properly sized and located.
- B. Establish lines, levels, and coursing. Protect from disturbance.
- C. Provide temporary bracing during erection of masonry work. Maintain in place until building structure provides permanent bracing.
- D. Scaffolding: Provide, erect, maintain, move, and finally remove scaffolding and staging required for masonry installation. Construct and maintain scaffolding in compliance with applicable ordinances, laws, rules and regulations. Scaffolding shall be sufficiently substantial to support workmen, and necessary materials and equipment. Provide adequate guard rails for protection of property, workmen, and passerby.

3.3 COURSING

- A. Place masonry to lines and level indicated.
- B. Arrange and trim stones for adequate fit in a range ashlar Pattern with course heights as indicated, random lengths, uniform joint widths with offset between vertical joints as indicated.

3.4 PLACING AND BONDING

- A. Lay masonry in full bed of mortar (horizontal, vertical, and collar joints), properly jointed with other work. Buttering corners of joints and deep or excessive furrowing of mortar joints is not permitted.
- B. Fully bond intersections, and external and internal corners.
- C. Do not shift, or tap masonry units after mortar has taken initial set. Where adjustment must be made, remove mortar and replace.
- D. Remove excess mortar on surface and in cavities.
- E. Perform job site saw cutting with proper tools to provide straight unchipped edges. Take care to prevent breaking masonry unit corners or edges.

3.5 TOLERANCES

- A. Alignment of Columns: Maximum of 6 mm (1/4 inch) from true line.
- B. Variation from Unit to Adjacent Unit: 0.8 mm (1/32 inch) maximum.
- C. Variation from Plane of Wall: 6 mm (1/4 inch) in 3 m (10 feet) and 12 mm (1/2 inch) in 6 m (20 feet) or more.
- D. Variation from Plumb: 6 mm (1/4 inch) per story non-cumulative, 12 mm (1/2 inch) in two stories or more.
- E. Variation from Level Coursing: 3 mm (1/8 inch) in 1 m (3 feet); 6 mm (1/4 inch) in 3 m (10 feet); 6 mm (1/4 inch) maximum.
- F. Variation of Joint Thickness: 3 mm (1/8 inch) in 1 m (3 feet).
- G. Maximum variation from Cross Sectional Thickness of Walls: Plus or minus 6 mm (1/4 inch).

3.6 REINFORCEMENT AND ANCHORAGES

- A. Attach wall ties to wall studs (or other solid and secure framing members) for veneer construction at maximum 400 mm (16 inches) oc vertically and 400 mm (16 inches) oc horizontally. Place at maximum 200 mm (8 inches) oc (or every third course) each way around perimeter of openings, within 300 mm (12 inches) of openings.

- B. Anchor stone veneer to unit masonry with metal veneer anchors as follows:
 - 1. Secure wire anchors by inserting pintles into eyes of masonry wall reinforcement projecting from horizontal mortar joints.
 - 2. Embed anchors in veneer mortar joints to within 25 mm (1 inch) of face.

3.7 LINTELS

- A. Install loose steel lintels as scheduled or shown. Leave space at end of lintels to expand.

3.8 WEEPS AND VENTS

- A. Install weep holes in veneer at 600 mm (24 inches) on center horizontally for clay masonry and 800 mm (32 inches) on center for 400 mm (16 inch) long concrete masonry, above through-wall flashing, above shelf angles, and at bottom of walls.

3.9 CONTROL/EXPANSION JOINTS

- A. Do not continue horizontal joint reinforcing across control joints.
- B. Size control joints in accordance with Section 07 92 00 for sealant performance, but in no case larger than adjacent mortar joints in exposed face brick.
- C. Provide expansion joints as indicated.

3.10 CLEANING

- A. Remove excess mortar and smears.
- B. Replace defective mortar. Match adjacent work.
- C. Clean soiled surfaces with non-acidic solution which will not harm masonry or adjacent materials. Consult masonry manufacturer for acceptable cleaners. Leave surfaces thoroughly clean and free of all mortar and other soiling.
- D. Use non-metallic tools in cleaning operations.
- E. ASTM C1515 and D7089.

3.11 PROTECTION

- A. Maintain protective boards at exposed external corners which may be damaged by construction activities.
- B. Provide protection without damaging completed work.
- C. Keep expansion joint voids clear of mortar.

END OF SECTION

SECTION 07 11 13

BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The Work of this Section specifies materials and workmanship for bituminous dampproofing on concrete and masonry surfaces.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Product description.
 - 2. Application instructions.

1.3 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Use the latest edition of the referenced publication.
- B. American Society for Testing and Materials (ASTM):
 - D226Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
 - D449Asphalt Used in Dampproofing and Waterproofing
 - D1227Emulsified Asphalt Used as a Protective Coating for Roofing

PART 2 - PRODUCTS

2.1 ASPHALT (HOT APPLIED)

- A. ASTM D449, Type I.

2.2 ASPHALT SATURATED FELT

- A. ASTM D226, Type I, 15 pound.

2.3 ASPHALT EMULSION (COLD APPLIED)

- A. ASTM D1227, Type III (spray grade)

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

- A. Surfaces to receive dampproofing shall be clean and smooth.
- B. Remove foreign matter, loose particles of mortar or other cementitious droppings.
- C. Clean and wash soil or dirt particles from surface.
- D. Remove free water; surfaces may remain damp.

3.2 APPLICATION

- A. Comply with Manufacturer written instructions for methods and rates of dampproofing application, cleaning and installation of any protection course.
- B. Apply each coat at the rate of not less than 2-1/2 gallons per 100 square feet and allow not less than 24 hours drying time after application.

3.3 LOCATION

- A. Apply to surfaces where shown.
- B. Apply to exterior surface of inner wythe of masonry cavity walls where shown. Coordinate application with masonry Work.

END OF SECTION

SECTION 07 92 00

JOINT SEALANTS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The Work of this Section covers all sealant and caulking materials and their application, wherever required for complete installation of building materials or systems.

1.2 RELATED WORK

- A. Sealing of site Work concrete paving: Section 32 05 23, CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS.
- B. Masonry control and expansion joint: Section 04 20 00, UNIT MASONRY.

1.3 QUALITY CONTROL

- A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose Work has resulted in joint-sealant installations with a record of successful in-service performance.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.
- C. Product Testing: Obtain test results from a qualified testing agency based on testing current sealant formulations within a 12-month period.
 - 1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021.
 - 2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C920, and where applicable, to other standard test methods.
 - 3. Test other joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.
- D. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to joint substrates in accordance with sealant manufacturer's recommendations:
 - 1. Locate test joints where indicated or, if not indicated, as directed by COTR.
 - 2. Conduct field tests for each application indicated below:
 - a. Each type of elastomeric sealant and joint substrate indicated.
 - b. Each type of non-elastomeric sealant and joint substrate indicated.
 - 3. Notify COTR seven days in advance of dates and times when test joints will be erected.

4. Arrange for tests to take place with joint sealant manufacturer's technical representative present.

E. VOC: Acrylic latex and Silicon sealants shall have less than 50g/l VOC content.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's installation instructions for each product used.
- C. Cured samples of exposed sealants for each color where required to match adjacent material.
- D. Manufacturer's Literature and Data:
 1. Caulking compound
 2. Primers
 3. Sealing compound, each type, including compatibility when different sealants are in contact with each other.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations:
 1. Do not proceed with installation of joint sealants under following conditions:
 - a. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40 °F.
 - b. When joint substrates are wet.
- B. Joint-Width Conditions:
 1. Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
- C. Joint-Substrate Conditions:
 1. Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.6 DELIVERY, HANDLING, AND STORAGE

- A. Deliver materials in manufacturers' original unopened containers, with brand names, date of manufacture, shelf life, and material designation clearly marked thereon.
- B. Carefully handle and store to prevent inclusion of foreign materials.
- C. Do not subject to sustained temperatures less than 40° F or exceeding 90° F.

1.7 DEFINITIONS

- A. Definitions of terms in accordance with ASTM C717 and as specified.
- B. Back-up Rod: A type of sealant backing.
- C. Bond Breakers: A type of sealant backing.
- D. Filler: A sealant backing used behind a back-up rod.

1.8 WARRANTY

- A. Warranty exterior sealing against leaks, adhesion, and cohesive failure, and subject to terms of "Warranty of Construction", FAR clause 52.246-21, except that warranty period shall be extended to two years.
- B. General Warranty: Special warranty specified in this Article shall not deprive Government of other rights Government may have under other provisions of Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of Contract Documents.

1.9 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only. Use the latest edition of the referenced publication.
- B. American Society for Testing and Materials (ASTM):
 - C509 Elastomeric Cellular Preformed Gasket and Sealing Material.
 - C612 Mineral Fiber Block and Board Thermal Insulation.
 - C717 Standard Terminology of Building Seals and Sealants.
 - C834 Latex Sealants.
 - C920 Elastomeric Joint Sealants.
 - C1021 Laboratories Engaged in Testing of Building Sealants.
 - C1193 Standard Guide for Use of Joint Sealants.
 - C1330 Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.
 - D1056 Specification for Flexible Cellular Materials—Sponge or Expanded Rubber.
 - E84 Surface Burning Characteristics of Building Materials.
- C. Sealant, Waterproofing and Restoration Institute (SWRI).
The Professionals' Guide

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Provide color of exposed joint sealants as selected. Custom colors will be used to provide blending of finish colors.
- B. Provide joint sealers, joint fillers and other materials that are compatible with one another and with joint substrates, as demonstrated by testing and field experience.

2.2 ELASTOMERIC JOINT SEALANTS

- A. Exterior Building Sealant: One-part silicone complying with ASTM C920, Type S, Grade NS, Class 25, Use NT, M, G, A, and O. Dow Corning Corp. "790", Tremco "Spectrem 1" or approved equal. Sealant shall resist ultra-violet, heat, ozone and moisture exposure and shall withstand substrate surface temperatures as high as 250-deg. F.
- B. Horizontal Joint Sealant: Two-part pourable urethane; ASTM C920, Type M; Grade P; Class 25; Uses T, M, A and O; Pecora Corp. "NR-200 Urexpan", Sonneborn "Sonolastic Paving Joint Sealant", Tremco, Inc. "THC-900/901" or approved equal. Horizontal joint sealant shall have a minimum Shore A hardness of 30.

2.3 CAULKING COMPOUND

- A. C-1: ASTM C834, acrylic latex.
- B. C-2: One component acoustical caulking, non drying, non hardening, synthetic rubber.

2.4 JOINT SEALANT BACKING

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Plastic Foam Joint-Fillers: Preformed, compressible, resilient, non-waxing, non-extruding strips of plastic foam, of size, shape and density to control sealant depth.
- C. Cylindrical Sealant Backings: ASTM C1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
 - 1. Type C: Closed-cell material with a surface skin.
- D. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D1056, nonabsorbent to water and gas, and capable of

remaining resilient at temperatures down to minus minus 26° F. Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.

- E. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.5 MISCELLANEOUS MATERIALS

- A. Filler: Mineral fiber board: ASTM C612 Class 1. Thickness same as joint width. Depth to fill void completely behind back-up rod.
- B. Primer: As recommended by joint sealant manufacturer for adhesion of sealant to joint substrates. Stain free type.
- C. Cleaners for Nonporous Surfaces: Non-staining, chemical cleaner of type acceptable to manufacturer of sealant and sealant backing materials which are not harmful to substrates and adjacent nonporous materials and formulated to promote adhesion of sealant and substrates.
- D. Masking Tape: Non-staining, non-absorbent type compatible with joint sealants and to surfaces adjacent to joints.

2.6 COLOR

- A. Sealants used with exposed masonry shall match color of mortar joints.
- B. Sealants used with unpainted concrete shall match color of adjacent concrete.
- C. Color of sealants for other locations shall be light gray or aluminum, unless specified otherwise.
- D. Caulking shall be light gray or white, unless specified otherwise.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Inspect substrate surface for bond breaker contamination and unsound materials at adherent faces of sealant.
- B. Coordinate for repair and resolution of unsound substrate materials.
- C. Inspect for uniform joint widths and that dimensions are within tolerance established by sealant manufacturer.

3.2 PREPARATIONS

- A. Prepare joints in accordance with manufacturer's instructions and SWRI.

- B. Clean surfaces of joint to receive sealants leaving joint dry to the touch, free from frost, moisture, grease, oil, wax, lacquer paint, or other foreign matter that would tend to destroy or impair adhesion.
 - 1. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants.
 - 2. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air. Porous joint surfaces include the following:
 - a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
 - 3. Remove laitance and form-release agents from concrete.
 - 4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
 - a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
 - d. Glazed surfaces of ceramic tile.
- C. Do not cut or damage joint edges.
- D. Apply masking tape to face of surfaces adjacent to joints before applying primers, caulking, or sealing compounds.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- E. Apply primer to sides of joints wherever required by compound manufacturer's printed instructions.
 - 1. Apply primer prior to installation of back-up rod or bond breaker tape.
 - 2. Use brush or other approved means that will reach all parts of joints.
- F. Take all necessary steps to prevent three sided adhesion of sealants.

3.3 BACKING INSTALLATION

- A. Install back-up material, to form joints enclosed on three sides as required for specified depth of sealant.
- B. Where deep joints occur, install filler to fill space behind the back-up rod and position the rod at proper depth.
- C. Cut fillers installed by others to proper depth for installation of back-up rod and sealants.
- D. Install back-up rod, without puncturing the material, to a uniform depth, within plus or minus 1/8 inch for sealant depths specified.

- E. Where space for back-up rod does not exist, install bond breaker tape strip at bottom (or back) of joint so sealant bonds only to two opposing surfaces.
- F. Take all necessary steps to prevent three sided adhesion of sealants.

3.4 SEALANT DEPTHS AND GEOMETRY

- A. At widths up to 1/4 inch, sealant depth equal to width.
- B. At widths over 1/4 inch, sealant depth 1/2 of width up to 1/2 inch maximum depth at center of joint with sealant thickness at center of joint approximately 1/2 of depth at adhesion surface.

3.5 INSTALLATION

- A. General:
 - 1. Comply with manufacturer's written installation instructions for products and applications indicated.
- B. For application of sealants, follow requirements of ASTM C1193 for use of joint sealants as applicable to materials, applications and conditions indicated unless specified otherwise.

3.6 PROTECTION AND CLEANING

- A. Protect joint sealants during and after curing period from contact with contaminating substances or from damage.
- B. Cut out and remove damaged or deteriorated joint sealers and reseal joints with matching new materials.
- C. Clean fresh compound accidentally smeared on adjoining surfaces: Scrape off immediately and rub clean with a solvent as recommended by the caulking or sealant manufacturer.
- D. After filling and finishing joints, remove masking tape.
- E. Leave adjacent surfaces in a clean and unstained condition.

3.7 LOCATIONS

- A. As indicated.
- B. Exterior Building Joints, Horizontal and Vertical:
 - 1. Metal to Metal: Type S-1, S-2
 - 2. Metal to Masonry or Stone: Type S-1
 - 3. Masonry to Masonry or Stone: Type S-1
 - 4. Stone to Stone: Type S-1
 - 5. Cast Stone to Cast Stone: Type S-1
 - 6. Threshold Setting Bed: Type S-1, S-3, S-4
 - 7. Masonry Expansion and Control Joints: Type S-6
 - 8. Wood to Masonry: Type S-1

- C. Metal Reglets and Flashings:
 - 1. Flashings to Wall: Type S-6
 - 2. Metal to Metal: Type S-6
- D. Horizontal Traffic Joints:
 - 1. Concrete Paving, Unit Pavers: Type S-11 or S-12
- E. Interior Caulking:
 - 1. Typical Narrow Joint 6 mm, (1/4 inch) or less at Walls and Adjacent Components: Types C-1, C-2 and C-3.
 - 2. Perimeter of Doors, Windows, Access Panels which Adjoin Concrete or Masonry Surfaces: Types C-1, C-2 and C-3.
 - 3. Joints at Masonry Walls and Columns, Piers, Concrete Walls or Exterior Walls: Types C-1, C-2 and C-3.
 - 4. Exposed Isolation Joints at Top of Full Height Walls: Types C-1, C-2 and C-3.

END OF SECTION

SECTION 09 91 00

PAINTING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Section specifies prime coats which may be applied in shop under other sections.
- B. Painting includes coatings specified..
- C. Work includes repainting of new, reinstalled and existing columbarium wall and pier caps that are to remain in place. Color to match existing paint color.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
Before work is started, or sample panels are prepared, submit manufacturer's literature, the current Master Painters Institute (MPI) "Approved Product List" indicating brand label, product name and product code as of the date of contract award, will be used to determine compliance with the submittal requirements of this specification. The Contractor may choose to use subsequent MPI "Approved Product List", however, only one list may be used for the entire contract and each coating system is to be from a single manufacturer. All coats on a particular substrate must be from a single manufacturer. No variation from the MPI "Approved Product List" where applicable is acceptable.
- C. Samples:
 - 1. After painters' materials have been approved and before work is started submit samples showing each type of finish and color specified.
 - 2. Samples to show color: Composition board, 6 inch by 6 inch.
- D. Manufacturers' Certificates indicating compliance with specified requirements:
 - 1. Manufacturer's paint substituted for Federal Specification paints meets or exceeds performance of paint specified.

1.3 DELIVERY AND STORAGE

- A. Deliver materials to site in manufacturer's sealed container marked to show following:
 - 1. Name of manufacturer.
 - 2. Product type.
 - 3. Batch number.
 - 4. Instructions for use.
 - 5. Safety precautions.

- B. In addition to manufacturer's label, provide a label legibly printed as following:
 - 1. Federal Specification Number, where applicable, and name of material.
 - 2. Surface upon which material is to be applied.
 - 3. If paint or other coating, state coat types; prime, body or finish.
- C. Maintain space for storage, and handling of painting materials and equipment in a neat and orderly condition to prevent spontaneous combustion from occurring or igniting adjacent items.
- D. Store materials at site at least 24 hours before using, at a temperature between 18 and 30 degrees C (65 and 85 degrees F).

1.4 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only.
- B. American Conference of Governmental Industrial Hygienists (ACGIH):
 - ACGIH TLV-BKLT-2009 Threshold Limit Values (TLV) for Chemical Substances and Physical Agents and Biological Exposure Indices (BEIs)
 - ACGIH TLV-DOC-2009 Documentation of Threshold Limit Values and Biological Exposure Indices, (Seventh Edition)
- C. American Society for Testing and Materials (ASTM):
 - D260-86 (2001).....Boiled Linseed Oil
- D. Federal Specifications (Fed Spec):
 - TT-P-1411A.....Paint, Copolymer-Resin, Cementitious (For Waterproofing Concrete and Masonry Walls) (CEP)
- E. Master Painters Institute (MPI):
 - No. 4-08.....Interior/ Exterior Latex Block Filler
 - No. 10-07.....Exterior Latex, Flat (AE)
 - No. 11-07.....Exterior Latex, Semi-Gloss (AE)
 - No. 134-06.....Primer, Galvanized, Water Based
 - No. 135-06.....Non-Cementitious Galvanized Primer

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Exterior Latex, Flat (AE): MPI 10.
- B. Exterior Latex, Semi-Gloss (AE): MPI 11.
- C. Waterborne Galvanized Primer: MPI 134.

- D. Non-Cementitious Galvanized Primer: MPI 135.

2.2 PAINT PROPERTIES

- A. Use ready-mixed (including colors), except two component epoxies, polyurethanes, polyesters, paints having metallic powders packaged separately and paints requiring specified additives.
- B. Where no requirements are given in the referenced specifications for primers, use primers with pigment and vehicle, compatible with substrate and finish coats specified.

2.3 REGULATORY REQUIREMENTS/QUALITY ASSURANCE

- A. Paint materials shall conform to the restrictions of the local Environmental and Toxic Control jurisdiction.
1. Volatile Organic Compounds (VOC): VOC content of paint materials shall not exceed 10g/l for interior latex paints/primers and 50g/l for exterior latex paints and primers.
 2. Lead-Base Paint:
 - a. Lead based paint is not permitted to be used.
 3. Asbestos: Materials shall not contain asbestos.
 4. Chromate, Cadmium, Mercury, and Silica: Materials shall not contain zinc-chromate, strontium-chromate, Cadmium, mercury or mercury compounds or free crystalline silica.
 5. Human Carcinogens: Materials shall not contain any of the ACGIH-BKLT and ACGHI-DOC confirmed or suspected human carcinogens.
 6. Use high performance acrylic paints in place of alkyd paints, where possible.
 7. VOC content for solvent-based paints shall not exceed 250g/l and shall not be formulated with more than one percent aromatic hydro carbons by weight.

PART 3 - EXECUTION

3.1 JOB CONDITIONS

- A. Safety: Observe required safety regulations and manufacturer's warning and instructions for storage, handling and application of painting materials.
1. Take necessary precautions to protect personnel and property from hazards due to falls, injuries, toxic fumes, fire, explosion, or other harm.
 2. Deposit soiled cleaning rags and waste materials in metal containers approved for that purpose. Dispose of such items off the site at end of each day's work.
- B. Atmospheric and Surface Conditions:
1. Do not apply coating when air or substrate conditions are:
 - a. Less than 5 degrees F above dew point.
 - b. Below 50 degrees F or over 95 degrees F, unless specifically pre-approved by the Contracting Officer and the product

manufacturer. Under no circumstances shall application conditions exceed manufacturer recommendations.

2. Do no exterior painting when it is windy and dusty.
3. Do not paint in direct sunlight or on surfaces that the sun will soon warm.
4. Apply only on clean, dry and frost free surfaces except as follows:
 - a. Apply water thinned acrylic and cementitious paints to damp (not wet) surfaces where allowed by manufacturer's printed instructions.
 - b. Dampened with a fine mist of water on hot dry days concrete and masonry surfaces to which water thinned acrylic and cementitious paints are applied to prevent excessive suction and to cool surface.

3.2 SURFACE PREPARATION

- A. Method of surface preparation is optional, provided results of finish painting produce solid even color and texture specified with no overlays.
- B. General:
 1. Remove items for reinstallation and complete painting of such items and adjacent areas when item or adjacent surface is not accessible or finish is different.
 2. Clean surfaces for painting with materials and methods compatible with substrate and specified finish. Remove any residue remaining from cleaning agents used. Do not use solvents, acid, or steam on concrete and masonry.
- C. Masonry, Concrete, Cement Board, Cement Plaster and Stucco:
 1. Clean and remove dust, dirt, oil, grease efflorescence, form release agents, laitance, and other deterrents to paint adhesion.
 2. Use emulsion type cleaning agents to remove oil, grease, paint and similar products. Use of solvents, acid, or steam is not permitted.
 3. Remove loose mortar in masonry work.
 4. Replace mortar and fill open joints, holes, cracks and depressions with new mortar specified in Section 04 05 13, MASONRY MORTARING, Section 04 05 16, MASONRY GROUTING. Do not fill weep holes. Finish to match adjacent surfaces.
 5. Repair broken and spalled concrete edges with concrete patching compound to match adjacent surfaces as specified in CONCRETE Sections. Remove projections to level of adjacent surface by grinding or similar methods.

3.3 PAINT PREPARATION

- A. Thoroughly mix painting materials to ensure uniformity of color, complete dispersion of pigment and uniform composition.
- B. Do not thin unless necessary for application and when finish paint is used for body and prime coats. Use materials and quantities for thinning as specified in manufacturer's printed instructions.

- C. Remove paint skins, then strain paint through commercial paint strainer to remove lumps and other particles.
- D. Mix two component and two part paint and those requiring additives in such a manner as to uniformly blend as specified in manufacturer's printed instructions unless specified otherwise.
- E. For tinting required to produce exact shades specified, use color pigment recommended by the paint manufacturer.

3.4 APPLICATION

- A. Start of surface preparation or painting will be construed as acceptance of the surface as satisfactory for the application of materials.
- B. Unless otherwise specified, apply paint in three coats; prime, body, and finish. When two coats applied to prime coat are the same, first coat applied over primer is body coat and second coat is finish coat.
- C. Apply each coat evenly and cover substrate completely.
- D. Allow not less than 48 hours between application of succeeding coats, except as allowed by manufacturer's printed instructions, and approved by COTR.
- E. Finish surfaces to show solid even color, free from runs, lumps, brushmarks, laps, holidays, or other defects.
- F. Apply by brush, roller or spray, except as otherwise specified.

3.5 PRIME PAINTING

- A. After surface preparation, prime surfaces before application of body and finish coats, except as otherwise specified.
- B. Spot prime and apply body coat to damaged and abraded painted surfaces before applying succeeding coats.
- C. Additional field applied prime coats over shop or factory applied prime coats are not required except for exterior exposed steel. Apply an additional prime coat.
- D. Concrete Masonry Units except glazed or integrally colored and decorative units:
 - 1. Prime exterior surface as specified for exterior finishes.

3.6 EXTERIOR FINISHES

- A. Apply following finish coats where shown on Contract Drawings.
- B. Machinery without factory finish except for primer: One coat MPI 8 (Exterior Alkyd, Flat (EO)), MPI 9 (Exterior Alkyd Enamel (EO)), MPI 94 (Exterior Alkyd, Semi-Gloss (EO)).
- C. Masonry and Concrete Walls:

1. Over MPI 4 (Interior/Exterior Latex Block Filler) on CMU surfaces.
2. Two coats of MPI 53 (Interior Latex, Flat, MPI Gloss Level 1 (LE)).

3.7 REFINISHING EXISTING PAINTED SURFACES

- A. Clean, patch and repair existing surfaces as specified under surface preparation.
- B. Remove and reinstall items as specified under surface preparation.
- C. Remove existing finishes or apply separation coats to prevent non compatible coatings from having contact.
- D. Patched or Replaced Areas in Surfaces and Components: Apply spot prime and body coats as specified for new work to repaired areas or replaced components.
- E. Except where scheduled for complete painting apply finish coat over plane surface to nearest break in plane, such as corner, reveal, or frame.
- F. Refinish areas as specified for new work to match adjoining work unless specified or scheduled otherwise.
- G. Sand or dull glossy surfaces prior to painting.
- H. Sand existing coatings to a feather edge so that transition between new and existing finish will not show in finished work.

3.8 PAINT COLOR

- A. Color and gloss of finish coats to match existing.
- B. Coat Colors:
 1. Color of priming coat: Lighter than body coat.
 2. Color of body coat: Lighter than finish coat.
 3. Color prime and body coats to not show through the finish coat and to mask surface imperfections or contrasts.

3.9 PROTECTION CLEAN UP, AND TOUCH-UP

- A. Protect work from paint droppings and spattering by use of masking, drop cloths, removal of items or by other approved methods.
- B. Upon completion, clean paint from hardware and other surfaces and items not required to be painted of paint drops or smears.
- C. Before final inspection, touch-up or refinished in a manner to produce solid even color and finish texture, free from defects in work which was damaged or discolored.

3.10 APPENDIX

- A. The following abbreviations are used in Section 09 91 00, PAINTING.

Paint or coating	Abbreviation
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Santa Fe National Cemetery Repair Columbarium 2 Wall
VA Project Number: 904CM3927

Acrylic Emulsion	AE (MPI 10 – flat/MPI 11 – semigloss/MPI 119 - gloss)
Alkyd Flat	Ak (MPI 49)
Alkyd Gloss Enamel	G (MPI 48)
Alkyd Semigloss Enamel	SG (MPI 47)
Aluminum Paint	AP)
Cementitious Paint	CEP (TT-P-1411)
Exterior Latex	EL??(MPI 10 / 11 / 119)
Exterior Oil	EO (MPI 9 – gloss/MPI 8 – flat/MPI 94 – semigloss)
Epoxy Coating	EC (MPI 77 – walls, floors/MPI 108 – CMU, concrete)
Fire Retardant Paint	FR
Fire Retardant Coating (Clear)	FC (intumescent type)
Floor Enamel	FE (MPI 27 – gloss/MPI 59 – eggshell)
Heat Resistant Paint	HR
Latex Emulsion	LE (MPI 53, flat/MPI 52, eggshell/MPI 54, semigloss/MPI 114, gloss Level 6
Latex Flat	LF (MPI 138)
Latex Gloss	LG (MPI 114)
Latex Semigloss	SG (MPI 141)
Latex Low Luster	LL (MPI 139)
Plastic Floor Coating	PL
Polyurethane Varnish	PV (
Rubber Paint	RF (CID-A-A-3120 - Paint for Swimming Pools (RF)).
Water Paint, Cement	WPC (CID-A-A-1555 - Water Paint, Powder).

END OF SECTION

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SECTION 31 20 00

EARTH MOVING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the requirements for furnishing all equipment, materials, labor, tools, and techniques for earthwork including, but not limited to, the following:
1. Site preparation.
 2. Excavation.
 3. Underpinning.
 4. Filling and backfilling.
 5. Grading.
 6. Soil Disposal.
 7. Clean Up.

1.2 DEFINITIONS

- A. Unsuitable Materials:
1. Fills: Topsoil; frozen materials; construction materials and materials subject to decomposition; clods of clay and stones larger than 75 mm (3 inches); organic material, including silts, which are unstable; and inorganic materials, including silts, too wet to be stable and any material with a liquid limit and plasticity index exceeding 40 and 15 respectively. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction, as defined by ASTM D 1557.
 2. Existing Subgrade (Except Footing Subgrade): Same materials as 1.2.A.1, that are not capable of direct support of slabs, pavement, and similar items with possible exception of improvement by compaction, proofrolling, or similar methods.
 3. Existing Subgrade (Footings Only): Same as subparagraph 1, but no fill or backfill. If materials differ from reference borings and design requirements, excavate to acceptable strata subject to COTR's approval.
- B. Trench Earthwork: Trenchwork required for utility lines.
- C. Site Earthwork: Earthwork operations required in area outside of a line located 1500 mm (5 feet) outside of principal building perimeter and within new construction area with exceptions noted above.
- D. Degree of compaction: Degree of compaction is expressed as a percentage of maximum density obtained by laboratory test procedure. This percentage of maximum density is obtained through use of data provided from results of field test procedures presented in ASTM D1556.

- E. Fill: Satisfactory soil materials used to raise existing grades. In the Construction Documents, the term “fill” means fill or backfill as appropriate. Stockpiles shown on plans as graded, permanent or semi-permanent land forms are subject to the requirements of “fill”.
- F. Backfill: Soil materials or controlled low strength material used to fill an excavation.
- G. Unauthorized excavation: Removal of materials beyond indicated sub-grade elevations or indicated lines and dimensions without written authorization by the COTR. No payment will be made for unauthorized excavation or remedial work required to correct unauthorized excavation.
- H. Authorized additional excavation: Removal of additional material authorized by the COTR based on the determination by the Government’s soils testing agency that unsuitable bearing materials are encountered at required sub-grade elevations. Removal of unsuitable material and its replacement as directed will be paid on basis of Conditions of the Contract relative to changes in work.
- I. Subgrade: The undisturbed earth or the compacted soil layer immediately below granular base, drainage fill, or topsoil materials.
- J. Structure: Buildings, foundations, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- K. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.
- L. Drainage course: Layer supporting slab-on-grade used to minimize capillary flow of pore water.
- M. Bedding course: Layer placed over the excavated sub-grade in a trench before laying pipe. Bedding course shall extend up to the spring line of the pipe.
- N. Base Course: Layer placed between the sub-grade and base course for asphalt paving or layer placed between the sub-grade and a concrete pavement or walk.
- O. Utilities include on-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.
- P. Debris: Debris includes all materials located within the designated work area not covered in the other definitions and shall include but not be limited to items like vehicles, equipment, appliances, building materials or remains thereof, tires, any solid or liquid chemicals or products stored or found in containers or spilled on the ground.
- Q. Contaminated soils: Soil that contains contaminants as defined and determined by the COTR.

1.3 RELATED WORK

- A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Safety requirements: Section 01 00 00, GENERAL CONDITIONS.
- C. Protection of existing utilities, fire protection services, existing equipment, roads, and pavements: Section 01 00 00, GENERAL REQUIREMENTS.
- D. Subsurface Investigation: Section 01 00 00, GENERAL REQUIREMENTS.
- E. Erosion Control: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.
- F. Site preparation: Section 02 41 00, DEMOLITION.
- G. Foundation system requirements: 31 32 23, PRESSURE GROUTING SOIL STABILIZATION.
- H. Paving sub-grade requirements: Section 32 05 23, CONCRETE FOR EXTERIOR IMPROVEMENTS.

1.4 SUBMITTALS:

- A. Submit for each Product indicated in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - D448-08..... Standard Classification for Sizes of Aggregate for Road and Bridge Construction
 - D698-07..... Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft. lbf/ft³ (600 kN m/m³))
 - D1556-07..... Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
 - D1557-07..... Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2700 kN m/m³))
 - D2167-08..... Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method
 - D2487-06..... Standard Classification of Soil for Engineering Purposes (Unified Soil Classification System)

D2922-05.....	Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
D2940-03.....	Standard Specifications for Graded Aggregate Material for Bases or Subbases for Highways or Airports

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Provide borrow soil material when sufficient satisfactory soil materials are not available from excavations.
- B. Bedding: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940; except with 100 percent passing a 25 mm (1 inch) sieve and not more than 8 percent passing a 75- μ m (No. 200) sieve.
- C. Drainage Fill: Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D448; coarse-aggregate grading Size 57; with 100 percent passing a 37.5 mm (1 1/2-inch) sieve and 0 to 5 percent passing a 2.36 mm (No. 8) sieve.
- D. Granular Fill:
 - 1. Under concrete slab, crushed stone or gravel graded from 25 mm (1 inch) to 4.75 mm (No. 4), per ASTM D2940.
 - 2. Bedding for sanitary and storm sewer pipe, crushed stone or gravel graded from 13 mm (1/2 inch) to 4.75 mm (No 4), per ASTM D2940.

PART 3 - EXECUTION

3.1 SITE PREPARATION

- A. Clearing: Clear within limits of earthwork operations as shown. Work includes removal of trees, shrubs, fences, foundations, incidental structures, paving, debris, trash, and other obstructions. Remove materials from Cemetery Property.
- B. Grubbing: Remove stumps and roots 75 mm (3 inch) and larger diameter. Undisturbed sound stumps, roots up to 75 mm (3 inch) diameter, and nonperishable solid objects a minimum of 900 mm (3 feet) below subgrade or finished embankment may be left. Cemetery Projects: do not leave material within burial profile up to 2400 mm (8 feet) below finished grade.
- C. Trees and Shrubs: Trees and shrubs, not shown for removal, may be removed from areas within 4500 mm (15 feet) of new construction and 2250 mm (7.5 feet) of utility lines when removal is approved in advance by COTR. Remove materials from Cemetery Property. Trees and shrubs, shown to be transplanted, shall be dug with a ball of earth and burlapped in accordance with latest issue of, "American Standard for Nursery Stock" of the American Association of Nurserymen, Inc. Transplant trees and shrubs to a permanent or temporary

position within two hours after digging. Maintain trees and shrubs held in temporary locations by watering as necessary and feeding semiannually with liquid fertilizer with a minimum analysis of 5 percent nitrogen, 10 percent phosphorus, and 5 percent potash. Maintain plants moved to permanent positions as specified for plants in temporary locations until conclusion of contract. Box, and otherwise protect from damage, existing trees and shrubs which are not shown to be removed in construction area. Immediately repair damage to existing trees and shrubs by trimming, cleaning and painting damaged areas, including roots, in accordance with standard industry horticultural practice for the geographic area and plant species. Do not store building materials closer to trees and shrubs, that are to remain, than farthest extension of their limbs.

- D. Stripping Topsoil: Strip topsoil from within limits of earthwork operations as specified. Topsoil shall be a fertile, friable, natural topsoil of loamy character and characteristic of locality. Topsoil shall be capable of growing healthy horticultural crops of grasses. Stockpile topsoil and protect as directed by COTR. Eliminate foreign materials, such as weeds, roots, stones, subsoil, frozen clods, and similar foreign materials larger than 0.014 m³ (1/2 cubic foot) in volume, from soil as it is stockpiled. Retain topsoil on station. Remove foreign materials larger than 50 mm (2 inches) in any dimension from topsoil used in final grading. Topsoil work, such as stripping, stockpiling, and similar topsoil work shall not, under any circumstances, be carried out when soil is wet so that the composition of the soil will be destroyed. Cemetery Projects: Test the soil for chemicals, pesticides and fertilizers if topsoil is to be removed from lands formerly utilized as farmland, to verify suitability for use as topsoil in the cemetery where new lawn areas are to be established.
- E. Concrete Slabs and Paving: Score deeply or saw cut to insure a neat, straight cut, sections of existing concrete slabs and paving to be removed where excavation or trenching occurs. Extend pavement section to be removed a minimum of 300 mm (12 inches) on each side of widest part of trench excavation and insure final score lines are approximately parallel unless otherwise indicated. Remove material from Cemetery Property.
- F. Lines and Grades: Registered Professional Land Surveyor or Registered Civil Engineer, specified in Section 01 00 00, GENERAL REQUIREMENTS, shall establish lines and grades.
 - 1. Grades shall conform to elevations indicated on plans within the tolerances herein specified. Generally grades shall be established to provide a smooth surface, free from irregular surface changes. Grading shall comply with compaction requirements and grade cross sections, lines, and elevations indicated. Where spot grades are indicated the grade shall be established based on interpolation of the elevations between the spot grades while maintaining appropriate transition at structures and paving and uninterrupted drainage flow into inlets.
 - 2. Locations of existing and proposed elevations indicated on plans, except spot elevations, are approximate from a site survey that measured spot elevations and subsequently generated existing contours and spot elevations. Proposed spot elevations and contour lines have been developed utilizing the existing conditions survey and developed contour

lines and may be approximate. Contractor is responsible to notify COTR of any differences between existing elevations shown on plans and those encountered on site by Surveyor/Engineer described above. Notify COTR of any differences between existing or constructed grades, as compared to those shown on the plans.

3. Subsequent to establishment of lines and grades, Contractor will be responsible for any additional cut and/or fill required to ensure that site is graded to conform to elevations indicated on plans.

- G. Disposal: All materials removed from the property shall be disposed of at a legally approved site, for the specific materials, and all removals shall be in accordance with all applicable Federal, State and local regulations. No burning of materials is permitted onsite.

3.2 EXCAVATION

- A. Excavation Drainage: Operate pumping equipment, and/or provide other materials, means and equipment as required to keep excavation free of water and subgrade dry, firm, and undisturbed until approval of permanent work has been received from COTR. Approval by the COTR is also required before placement of the permanent work on all subgrades.
- B. Subgrade Protection: Protect subgrades from softening, undermining, washout, or damage by rain or water accumulation. Reroute surface water runoff from excavated areas and not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches. When subgrade for foundations has been disturbed by water, remove disturbed material to firm undisturbed material after water is brought under control. Replace disturbed subgrade in trenches with concrete or material approved by the COTR.
- C. Blasting: Not permitted.
- D. Trench Earthwork:
 1. Storm sewer trenches:
 - a. Trench width below a point 150 mm (6 inches) above top of pipe shall be 600 mm (24 inches) maximum for pipe up to and including 300 mm (12 inches) diameter. Width of trench above that level shall be as necessary for sheeting and bracing and proper performance of the work.
 - b. Bed bottom quadrant of pipe on granular fill.
 - 1) Granular Fill: Depth of fill shall be a minimum of 75 mm (3 inches) plus one sixth of pipe diameter below pipe to 300 mm (12 inches) above top of pipe. Place and tamp fill material by hand.
 - c. Place and compact as specified remainder of backfill using acceptable excavated materials. Do not use unsuitable materials.
- E. Site Earthwork: Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil and other materials. Excavation shall be accomplished as required by drawings and specifications. Excavate to

indicated elevations and dimensions within a tolerance of plus or minus 25 mm (1 inch). Extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, complying with OSHA requirements, and for inspections. Remove subgrade materials that are determined by COTR as unsuitable, and replace with acceptable material. If there is a question as to whether material is unsuitable or not, the Contractor shall obtain samples of the material, under the direction of the COTR, and the materials shall be examined by an independent testing laboratory for soil classification to determine whether it is unsuitable or not. When unsuitable material is encountered and removed, Contract price and time will be adjusted in accordance with Articles, DIFFERING SITE CONDITIONS, CHANGES and CHANGES-SUPPLEMENT of the GENERAL REQUIREMENTS as applicable. Adjustments to be based on volume in cut section only.

1. Site Grading:
 - a. Provide a smooth transition between adjacent existing grades and new grades.
 - b. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
 - c. Slope grades to direct water away from buildings and to prevent ponds from forming where not designed. Finish subgrades to required elevations within the following tolerances:
 - 1) Lawn or Unpaved Areas: Plus or minus 25 mm (1 inch).
 - 2) Walks: Plus or minus 25 mm (1 inch).

3.3 FILLING AND BACKFILLING

- A. General: Do not fill or backfill until all debris, water, unsatisfactory soil materials, obstructions, and deleterious materials have been removed from excavation. For fill and backfill, use excavated materials and borrow meeting the criteria specified herein, as applicable. Borrow will be supplied at no additional cost to the Government. Do not use unsuitable excavated materials. Do not backfill until foundation walls have been completed above grade and adequately braced, waterproofing or dampproofing applied, foundation drainage, and pipes coming in contact with backfill have been installed and work inspected and approved by COTR.
- B. Placing: Place materials in horizontal layers not exceeding 200 mm (8 inches) in loose depth for material compacted by heavy compaction equipment, and not more than 100 mm (4 inches) in loose depth for material compacted by hand-operated tampers and then compacted. Place backfill and fill materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure. Place no material on surfaces that are muddy, frozen, or contain frost.
- C. Compaction: Compact with approved tamping rollers, sheepfoot rollers, pneumatic tired rollers, steel wheeled rollers, vibrator compactors, or other approved equipment (hand or mechanized) well suited to soil being compacted. Do not operate mechanized vibratory compaction equipment within 3000 mm (10 feet) of new or existing building walls without prior approval of Resident Engineer. Moisten or aerate material as necessary to provide moisture content that will readily facilitate obtaining specified compaction with equipment used.

Compact soil to not less than the following percentages of maximum dry density, according to ASTM D698 or ASTM D1557 as specified below:

1. Fills, Embankments, and Backfill, Natural Ground (Cut or Existing)
 - a. Under proposed structures and paved areas, scarify and recompact top 300 mm (12 inches) of existing subgrade and each layer of backfill or fill material in accordance with ASTM D1557, 95 percent.
 - b. Under Sidewalks, scarify and recompact top 150 mm (6 inches) below subgrade and compact each layer of backfill or fill material in accordance with ASTM D1557, 95 percent.

3.4 GRADING

- A. General: Uniformly grade the areas within the limits of this section, including adjacent transition areas. Smooth the finished surface within specified tolerance. Provide uniform levels or slopes between points where elevations are indicated, or between such points and existing finished grades. Provide a smooth transition between abrupt changes in slope.
- B. Cut rough or sloping rock to level beds for foundations. In pipe spaces or other unfinished areas, fill low spots and level off with coarse sand or fine gravel.
- C. Place crushed stone or gravel fill under concrete slabs on grade, tamped, and leveled. Thickness of fill shall be 150 mm (6 inches) unless otherwise shown.
- D. Finish subgrade in a condition acceptable to COTR at least one day in advance of paving operations. Maintain finished subgrade in a smooth and compacted condition until succeeding operation has been accomplished. Scarify, compact, and grade subgrade prior to further construction when approved compacted subgrade is disturbed by Contractor's subsequent operations or adverse weather.
- E. Grading for Paved Areas: Provide final grades for both subgrade and base course to +/- 6 mm (0.25 inches) of indicated grades.

3.5 DISPOSAL OF UNSUITABLE AND EXCESS EXCAVATED MATERIAL

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Cemetery property.

3.6 CLEAN UP

- A. Upon completion of earthwork operations, clean areas within contract limits, remove tools, and equipment. Provide site clear, clean, free of debris, and suitable for subsequent construction operations. Remove all debris, rubbish, and excess material from Cemetery Property.

END OF SECTION

SECTION 31 32 23

PRESSURE GROUTING SOIL STABILIZATION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section covers the application of cementitious grout into the ground at specified intervals within 10 feet on either side of the columbarium wall for the entire length of the columbarium wall.

1.2 EQUIPMENT

- A. Equipment shall be suitable for the work, as approved by the testing lab. Equipment shall be constructed to provide a positive seal for preventing the slurry from flowing out onto the ground and shall have controls and gauges for setting of pressure and determination of pressure.
- B. Packers of an acceptable type and length with a minimum diameter of 100 mm (4 in.) shall be utilized by the Contractor to prevent grout from flowing out onto the ground surface.
- C. Mixer tanks shall be approved by the testing lab and shall be continuously agitated to insure uniformity of mixture.

1.3 RELATED WORK

- A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Safety requirements: Section 01 00 00, GENERAL REQUIREMENTS.
- C. Protection of existing utilities, fire protection services, existing equipment, roads, and pavements: Section 01 00 00, GENERAL REQUIREMENTS.
- D. Subsurface Investigation: Section 01 00 00, GENERAL REQUIREMENTS, Article, PHYSICAL DATA.

1.4 QUALITY ASSURANCE

- A. Contractor Qualifications: Installation shall be done only by a specialty ground modification Contractor normally engaged in this business. All work shall be performed by qualified personnel working under an experienced supervisor.
 - 1. Submit design for cementitious grout product and compaction grouting process to COTR for approval prior to construction.
- B. Submit shop drawings and execution plan and technical data for all products specified and procedures utilized.

PART 2 - PRODUCT

2.1 GROUT

- A. Cement based grout:
 - 1. Portland Cement: ASTM C150, Type I or II, low alkali, natural gray.
 - 2. Fly Ash, Type F.
 - 3. Aggregate, Fine.
 - 4. Water, Potable.

PART 3 - EXECUTION

3.1 PROCEDURE

- A. Shape the subgrade rough to designed grades and scarified or plowed so that excess slurry will be trapped within the specified limits.
- B. Pre drill holes to accommodate the Contractor's inflatable packers to 900 mm (3 feet). The spacing for injections shall not exceed 1500 mm (5 feet) on center in each direction, and extend a minimum of 10 feet beyond the limits of the columbarium wall.
- C. Set and inflate packer or seal holes.
- D. Inject each hole through a packer at a minimum pressure of 350 kPa (50 psi) and a maximum of 1400 kPa (200 psi) pump pressure, adjusted to disperse the maximum possible volume of slurry, and continue to inject slurry to refusal, as defined by the testing lab.
- E. Continuously agitate the lime slurry to insure uniformity of mixture. Specific gravity checks shall be made at both mixer tanks and at injectors no less than one test per four hours of agitation.
- F. The Contractor shall insure that excess grout is applied evenly across the scarified or plowed sub-grade during the stabilization process. The excess grout ponded on the ground surface shall be scarified into the soil and the soil lime mixture re-compacted to sub-grade specifications prior to placement of fill, if required.
- G. Comply with the recommendations of the *Columbarium Wall 2, Santa Fe New Mexico* Geotechnical Investigation dated December 2, 2012 by Stevens, Ferrone & Bailey Engineering Company Inc, Report Number 361-10.
- H. Standard Penetration Resistance value at completion of grouting shall be a minimum of 25 based on two, 20-foot deep exploratory borings of each pressure grouted area (total of four borings). Follow recommendations in the Geotechnical Report for testing.

3.2 INSPECTION AND CONTROL

- A. The work shall be under the direct inspection of a representative of the testing lab who will measure the specific gravity of the mixture, determine suitable operation of the equipment used, and determine the point of injection refusal.
- B. Acceptance of the soil stabilization shall be on the basis of continuous on site inspection and testing by a representative of the testing lab. At the testing labs discretion, on site testing may include before and after testing of the sub-grade soils to evaluate the stabilization process. The post installation tests will typically be performed at seven days after injection to assure interaction with the lime and soil mixture. Typical tests may include standard penetration tests in accordance with ASTM D1586 or similar test as considered applicable by the testing laboratory. The Contractor may be required to inject portions of the site with lime slurry more than once to meet the approval of the testing lab.
- C. The testing lab shall be provided weight certificates of all lime delivered to the site for use in stabilization.

END OF SECTION

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SECTION 32 05 23

CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section shall cover site work concrete constructed upon the prepared subgrade and in conformance with the lines, grades, thickness, and cross sections shown. Construction shall include the following:
 - 1. Integrally Colored Concrete: Walks.

1.2 RELATED WORK

- A. Laboratory and Field Testing Requirements: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Subgrade Preparation: Section 31 20 00, EARTH MOVING.
- C. Concrete Materials, Quality, Mixing, Design and Other Requirements: Section 03 30 00, CAST-IN-PLACE CONCRETE.

1.3 WEATHER LIMITATIONS

- A. Placement of concrete shall be as specified under Article 3.4 E., for Cold Weather Placement and Article 3.4 D., for Cold Weather Placement of Section 03 30 00, CAST-IN-PLACE CONCRETE.

1.4 SUBMITTALS

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:
- B. Manufacturers' Certificates and Data certifying that the following materials conform to the requirements specified.
 - 1. Expansion joint filler
 - 2. Hot poured sealing compound
 - 3. Reinforcement
 - 4. Curing materials
 - 5. All other indicated Products
- C. Data and Test Reports: Select subbase material.
 - 1. Job-mix formula.
 - 2. Source, gradation, liquid limit, plasticity index, percentage of wear, and other tests as specified and in referenced publications.
- D. Samples:
 - 1. Submit pigment manufacturer's color chip sample for color approval; indicate pigment number and required dosage rate. Match to on-site concrete.

1.5 DELIVERY AND STORAGE

- A. Pigments: Comply with manufacturer's instructions with regards to delivery and storage. Deliver pigments in original, unopened packaging. Store in dry conditions.

1.6 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Refer to the latest edition of all referenced Standards and codes.
- B. American Association of State Highway and Transportation Officials (AASHTO):
M55M/55M-09 Welded Steel Wire Fabric for Concrete Reinforcement (ASTM A185)
M147-04 Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses (R 1996)
M148-05 Liquid Membrane-Forming Compounds for Curing Concrete (ASTM C309A)
M171-05 Sheet Materials for Curing Concrete (ASTM C171)
M182-05 Burlap Cloth Made from Jute or Kenaf
M213-05 Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Type) (ASTM D1751)
T99-09 Moisture-Density Relations of Soils Using a 2.5 kg. (5.5 lb) Rammer and a 305 mm (12 in.) Drop
T180-09 Moisture-Density Relations of Soils Using a 4.54 kg (10 lb.) Rammer and a 457 mm (18 in.) Drop
- C. American Society for Testing and Materials (ASTM):
C94/C94M-09 Ready-Mixed Concrete
C143/C143M-08 Slump of Hydraulic Cement Concrete
C979-05 Pigments for Integrally Colored Concrete

PART 2 - PRODUCTS

2.1 GENERAL

- A. Concrete shall be Type C, air-entrained as specified in Section 03 30 00, CAST-IN-PLACE CONCRETE, with the following exceptions:

TYPE	MAXIMUM SLUMP*
Pedestrian Pavement	75 mm (3")
* For concrete to be vibrated: Slump as determined by ASTM C143. Tolerances as established by ASTM C94.	

2.2 REINFORCEMENT

- A. The type, amount, and locations of steel reinforcement shall be as shown on the drawings and in the specifications.
- B. Welded wire-fabric shall conform to AASHTO M55.
- C. Dowels shall be plain steel bars conforming to AASHTO M31 or M42. Tie bars shall be deformed steel bars conforming to AASHTO M31 or M42.

2.3 BASE

- A. As required per Section 31 20 00, EARTH MOVING.

2.4 FORMS

- A. Use metal or wood forms that are straight and suitable in cross-section, depth, and strength to resist springing during depositing and consolidating the concrete, for the work involved.
- B. Do not use forms if they vary from a straight line more than 3 mm (1/8 inch) in any 3000 mm (ten foot) long section, in either a horizontal or vertical direction.
- C. Wood forms should be at least 50 mm (2 inches) thick (nominal). Wood forms shall also be free from warp, twist, loose knots, splits, or other defects. Use approved flexible or curved forms for forming radii.

2.5 CONCRETE CURING MATERIALS

- A. Concrete curing materials shall conform to one of the following:
 - 1. Burlap conforming to AASHTO M182 having a weight of 233 grams (seven ounces) or more per square meter (yard) when dry.
 - 2. Impervious Sheeting conforming to AASHTO M171.

2.6 EXPANSION JOINT FILLERS

- A. Joint filler shall be a preformed non-extruded resilient filler, saturated with bituminous materials and conforming to ASTM D 1751. Products shall be equivalent to Burke "Fiber Expansion Joint", W.R. Meadows "Fibrated Expansion Joint Filler", or approved equal.

2.7 PIGMENTS

- A. Pigments shall contain pure, concentrated mineral pigments especially processed for mixing into concrete and complying with ASTM C979.
- B. Packaging: for all pigments added to the mix at the Site, furnish pigments in pre-measured Mix-Ready disintegrating bags.
- C. Color:
 - 1. Pigment (Color-base on Davis color schedule) as necessary to match existing concrete pavement colors on site.

2.8 CEMENT, SAND, AGGREGATES AND OTHER ADDITIVES

- A. Cement, sand and aggregate color shall be as required to match paver colors as indicated in Paragraph 2.7.C.
- B. Provide silicon carbide or aluminum oxide grains as required to match paver colors indicated in Paragraph 2.7.C.

PART 3 - EXECUTION

3.1 SUBGRADE PENETRATION

- A. Prepare, construct, and finish the subgrade as specified in Section 31 20 00, EARTH MOVING.
- B. Maintain the subgrade in a smooth, compacted condition, in conformance with the required section and established grade until the succeeding operation has been accomplished.

3.2 BASE

- A. Placing:
 - 1. Place the material on the prepared subgrade in a uniform layer to the required contour and grades, and to a loose depth not to exceed 200 mm (8 inches), and that when compacted, will produce a layer of the designated thickness.
 - 2. When the designated compacted thickness exceeds 150 mm (6 inches), place the material in layers of equal thickness. Remove unsatisfactory areas and replace with satisfactory mixture, or mix the material in the area.
 - 3. In no case will the addition of thin layers of material be added to the top layer in order to meet grade.
 - 4. If the elevation of the top layer is 13 mm (1/2 inch) or more below the grade, excavate the top layer and replace with new material to a depth of at least 75 mm (3 inches) in compacted thickness.
- B. Compaction:
 - 1. Perform compaction with approved equipment (hand or mechanical) well suited to the material being compacted.
 - 2. Moisten or aerate the material as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used.
 - 3. Compact each layer to at least 95 percent or 100 percent of maximum density as determined by AASHTO T180 or AASHTO T99 respectively.
- C. Smoothness Test and Thickness Control:
 - 1. Test the completed base for grade and cross section with a straight edge.
 - a. The surface of each layer shall not show any deviations in excess of 10 mm (3/8 inch).

- b. The completed thickness shall be within 13 mm (1/2 inch) of the thickness as shown.

D. Protection:

- 1. Maintain the finished base in a smooth and compacted condition until the concrete has been placed.
- 2. When Contractor's subsequent operations or adverse weather disturbs the approved compacted base, excavate, and reconstruct it with new material meeting the requirements herein specified, at no additional cost to the VA.

3.3 SETTING FORMS

A. Base Support:

- 1. Compact the base material under the forms true to grade so that, when set, they will be uniformly supported for their entire length at the grade as shown.
- 2. Correct imperfections or variations in the base material grade by cutting or filling and compacting.

B. Form Setting:

- 1. Set forms sufficiently in advance of the placing of the concrete to permit the performance and approval of all operations required with and adjacent to the form lines.
- 2. Set forms to true line and grade and use stakes, clamps, spreaders, and braces to hold them rigidly in place so that the forms and joints are free from play or movement in any direction.
- 3. Forms shall conform to line and grade with an allowable tolerance of 3 mm (1/8 inch) when checked with a straightedge and shall not deviate from true line by more than 6 mm (1/4 inch) at any point.
- 4. Do not remove forms until removal will not result in damaged concrete or at such time to facilitate finishing.
- 5. Clean and oil forms each time they are used.

C. The Contractor's Registered Professional Land Surveyor, specified in Section 01 00 00, GENERAL REQUIREMENTS, shall establish and control the alignment and the grade elevations of the forms.

- 1. Make necessary corrections to forms immediately before placing concrete.
- 2. When any form has been disturbed or any subgrade or base has become unstable, reset and recheck the form before placing concrete.

3.4 EQUIPMENT

- A. The COTR shall approve equipment and tools necessary for handling materials and performing all parts of the work prior to commencement of work.
- B. Maintain equipment and tools in satisfactory working condition at all times.

3.5 PLACING REINFORCEMENT

- A. Reinforcement shall be free from dirt, oil, rust, scale or other substances that prevent the bonding of the concrete to the reinforcement.
- B. Before the concrete is placed, the COTR shall approve the reinforcement, which shall be accurately and securely fastened in place with suitable supports and ties. The type, amount, and position of the reinforcement shall be as shown.

3.6 MIXING PIGMENTS

- A. Mix pigments in accordance with manufacturer's instructions. Mix until pigments are uniformly dispersed throughout mixture and disintegrating bags have disintegrated.

3.7 PLACING CONCRETE - GENERAL

- A. Obtain approval of the COTR before placing concrete.
- B. Remove debris and other foreign material from between the forms before placing concrete. Obtain approval of the COTR before placing concrete.
- C. Before the concrete is placed, uniformly moisten the subgrade or base appropriately, avoiding puddles of water.
- D. Convey concrete from mixer to final place of deposit by a method which will prevent segregation or loss of ingredients. Deposit concrete so that it requires as little handling as possible.
- E. While being placed, spade or vibrate and compact the concrete with suitable tools to prevent the formation of voids or honeycomb pockets. Vibrate concrete well against forms and along joints. Over-vibration or manipulation causing segregation will not be permitted. Place concrete continuously between joints without bulkheads.
- F. Install a construction joint whenever the placing of concrete is suspended for more than 30 minutes and at the end of each day's work.
- G. Workmen or construction equipment coated with foreign material shall not be permitted to walk or operate in the concrete during placement and finishing operations.

3.8 PLACING CONCRETE FOR PEDESTRIAN PAVEMENTS

- A. Place concrete in the forms in one layer of such thickness that, when compacted and finished, it will conform to the cross section as shown.
- B. Deposit concrete as near to joints as possible without disturbing them but do not dump onto a joint assembly.

- C. After the concrete has been placed in the forms, use a strike-off guided by the side forms to bring the surface to the proper section to be compacted.
- D. Consolidate the concrete thoroughly by tamping and spading, or with approved mechanical finishing equipment.
- E. Finish the surface to grade with a wood or metal float.
- F. All Concrete pavements shall be constructed with sufficient slope to drain properly.

3.9 CONCRETE FINISHING - GENERAL

- A. The sequence of operations, unless otherwise indicated, shall be as follows:
 - 1. Consolidating, floating, straight-edging, troweling, texturing, and edging of joints.
 - 2. Maintain finishing equipment and tools in a clean and approved condition.

3.10 CONCRETE FINISHING PEDESTRIAN PAVEMENT

- A. Walks:
 - 1. Finish the surfaces to grade and cross section with a metal float, trowled smooth and finished with a broom moistened with clear water.
 - 2. Brooming shall be transverse to the line of traffic.
 - 3. Finish all slab edges, including those at formed joints, carefully with an edger having a radius as shown on the Drawings.
 - 4. Unless otherwise indicated, edge the transverse joints before brooming. The brooming shall eliminate the flat surface left by the surface face of the edger. Execute the brooming so that the corrugation, thus produced, will be uniform in appearance and not more than 2 mm (1/16 inch) in depth.
 - 5. The completed surface shall be uniform in color and free of surface blemishes, form marks, and tool marks. The finished surface of the pavement shall not vary more than 5 mm (3/16 inch) when tested with a 3000 mm (10 foot) straightedge.
 - 6. The thickness of the pavement shall not vary more than 6 mm (1/4 inch).
 - 7. Remove and reconstruct irregularities exceeding the above for the full length between regularly scheduled joints.

3.11 JOINTS - GENERAL

- A. Place joints, where shown, conforming to the details as shown, and perpendicular to the finished grade of the concrete surface.
- B. Joints shall be straight and continuous from edge to edge of the pavement.

3.12 CONTRACTION JOINTS

- A. Cut joints to depth as shown with a grooving tool or jointer of a radius as shown or by sawing with a blade producing the required width and depth.

- B. Construct joints by inserting 3 mm (1/8 inch) steel plates conforming to the cross sections.
- C. Plates shall remain in place until concrete has set sufficiently to hold its shape and shall then be removed.
- D. Finish edges of all joints with an edging tool having the radius as shown.
- E. Score pedestrian pavement with a standard grooving tool or jointer.

3.13 EXPANSION JOINTS

- A. Use a preformed expansion joint filler material of the thickness as shown to form expansion joints.
- B. Material shall extend the full depth of concrete, cut and shaped to the cross section as shown, except that top edges of joint filler shall be below the finished concrete surface where shown to allow for sealing.
- C. Anchor with approved devices to prevent displacing during placing and finishing operations.
- D. Round the edges of joints with an edging tool.
- E. Form expansion joints as follows:
 - 1. Without dowels, about structures and features that project through, into, or against any site work concrete construction.
 - 2. Using joint filler of the type, thickness, and width as shown.
 - 3. Installed in such a manner as to form a complete, uniform separation between the structure and the site work concrete item.

3.14 CONSTRUCTION JOINTS

- A. Place transverse construction joints of the type shown, where indicated and whenever the placing of concrete is suspended for more than 30 minutes.
- B. Use a butt-type joint with dowels if the joint occurs at the location of a planned joint.
- C. Use keyed joints with tiebars if the joint occurs in the middle third of the normal joint interval.

3.15 FORM REMOVAL

- A. Forms shall remain in place at least 12 hours after the concrete has been placed. Remove forms without injuring the concrete.
- B. Do not use bars or heavy tools against the concrete in removing the forms. Promptly repair any concrete found defective after form removal.

3.16 CURING OF CONCRETE

- A. Cure concrete by one of the following methods appropriate to the weather conditions and local construction practices, against loss of moisture, and rapid temperature changes for at least seven days from the beginning of the curing operation. Protect unhardened concrete from rain and flowing water. All equipment needed for adequate curing and protection of the concrete shall be on hand and ready to install before actual concrete placement begins. Provide protection as necessary to prevent cracking of the pavement due to temperature changes during the curing period. If any selected method of curing does not afford the proper curing and protection against concrete cracking, remove and replace the damaged pavement and employ another method of curing as directed by the Resident Engineer.
- B. Burlap Mat: Provide a minimum of two layers kept saturated with water for the curing period. Mats shall overlap each other at least 150 mm (6 inches).
- C. Impervious Sheeting: Use waterproof paper, polyethylene-coated burlap, or polyethylene sheeting. Polyethylene shall be at least 0.1 mm (4 mils) in thickness. Wet the entire exposed concrete surface with a fine spray of water and then cover with the sheeting material. Sheets shall overlap each other at least 300 mm (12 inches). Securely anchor sheeting.

3.17 CLEANING

- A. After completion of the curing period:
 - 1. Remove the curing material (other than liquid membrane).
 - 2. Sweep the concrete clean.
 - 3. After removal of all foreign matter from the joints, seal joints as herein specified.
 - 4. Clean the entire concrete of all debris and construction equipment as soon as curing and sealing of joints has been completed.

3.18 PROTECTION

- A. The contractor shall protect the concrete against all damage prior to final acceptance by the Government. Remove concrete containing excessive cracking, fractures, spalling, or other defects and reconstruct the entire section between regularly scheduled joints, when directed by the Resident Engineer, and at no additional cost to the Government. Exclude traffic from vehicular pavement until the concrete is at least seven days old, or for a longer period of time if so directed by the Resident Engineer.

3.19 FINAL CLEAN-UP

- A. Remove all debris, rubbish and excess material from the Station.

END OF SECTION

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SECTION 33 46 13

FOUNDATION DRAINAGE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies foundation drainage system, including installation, backfill, and cleanout extensions, to place of connection to onsite facilities.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Product Data: Certifications from the manufacturers attesting that materials meet specification requirements.

1.3 RELATED WORK

- A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Safety requirements: Section 01 00 00, GENERAL REQUIREMENTS.
- C. Protection of existing utilities, fire protection services, existing equipment, roads, and pavements: Section 01 00 00, GENERAL REQUIREMENTS.
- D. Subsurface Investigation: Section 01 00 00, GENERAL REQUIREMENTS.

1.4 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred in the text by basic designation only.
- B. American Association of State Highway and Transportation Officials (AASHTO):
 - M006-08-UL Standard Specification for Fine Aggregate for Hydraulic Cement Concrete, Single User Digital Publication
 - M252-08-UL Corrugated Polyethylene Drainage Pipe
 - M288-06-UL Geotextile Specification for Highway Applications
- C. American Society for Testing and Materials (ASTM):
 - D448-08..... Standard Classification for Sizes of Aggregate for Road and Bridge Construction
 - D2321-08..... Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

D2729-03.....	Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
D2737-03.....	Standard Specification for Polyethylene (PE) Plastic Tubing
F477-08	Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Pipe for foundation drainage system shall be of the type and size indicated. Appropriate transitions, adapters, or joint details shall be used where pipes of different types or materials are connected.
- B. Perforated Drainage Pipe:
 - 1. Perforated, PE pipe and fittings per ASTM D2737, in DN 100 to DN 150 (NPS 4 to NPS 6). Joints shall be coupling type.
- C. Cleanout Extension: ASTM D2729 PVC NPS 6. Gravity Sewer pipes shall have a neoprene gasket joints and long sweep elbow fittings. Cleanouts for underdrains shall be as indicated on the Construction Documents and shall be set so as to not interfere with mowing operations. Plastic tops for cleanouts in landscape areas shall be provided with concrete anchorage with all features set so as to not cause damage to the mowers.
- D. Drainage Conduit:
 - 1. Plastic Pipe: Corrugated, Polyethylene (HDPE) Plastic Pipe and Fittings: AASHTO M 252 Interim, Type S, with smooth waterway for coupling joints.
 - a. Soiltight Couplings: AASHTO M 252 Interim, corrugated, matching pipe and fittings to form soiltight joints.
 - 2. Filter Fabric
 - a. Non-Woven Filter fabric shall be a pervious sheet of polyethylene or polypropylene filaments formed into a uniform pattern with distinct and measurable openings. The filter fabric shall provide an equivalent opening size (AOS) no coarser than the US Standard Sieve No. 80. AOS is defined as the number of the US Standard sieve having openings closest in size to the filter fabric openings. Permittivity shall be minimum 1.5/second and water flow rate shall be minimum 110 gpm/ft². The filaments shall contain stabilizers and/or inhibitors added to the base plastic to make the filaments resistant to deterioration due to ultraviolet and heat exposure with minimum UV Resistance of 70% retained at 500 hours. The fabric shall have a minimum grab tensile strength of 200 pounds when tested in accordance with ASTM D 4632. Grab elongation shall be 50 percent. Puncture strength shall be 110 pounds when tested in accordance with ASTM D 4833. Mullen burst value shall be minimum 350 psi. Trapezoidal tear shall be minimum 80 lb when tested in accordance with ASTM D

4533. The fabric shall be constructed so that the filaments will retain their relative position with respect to each other.

- E. Drainage Material:
 - 1. Bedding: Crushed stone, 20 mm (3/4 inch) to 25 mm (No. 4) per ASTM D448.
 - 2. Fill to 300 mm (1 foot) above pipe: Crushed stone, 20 mm (3/4 inch) to 25 mm (No. 4) per ASTM D448.
- F. Concrete Sand: AASHTO M006.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Trenching and Excavation
 - 1. Perform required trenching and excavation in accordance with Section 31 20 00 EARTH MOVING. Keep trenches dry during installation of drainage system. Changes in direction of drain lines shall be made with 1/8 bends. Use wye fittings at intersections.
- B. Bedding
 - 1. Place graded bedding, minimum 6 inches in depth, in the bottom of trench for its full width and length compacted as specified prior to laying of foundation drain pipe. Each section shall rest firmly upon the bedding, through the entire length, with recesses formed for bell joints. Except for recesses for bell joints, the bedding shall fully support the lower quadrant of the pipe.
- C. Pipe Laying
 - 1. Lay drain lines to true grades and alignment with a continuous fall in the direction of flow. Bells of pipe sections shall face upgrade. Clean interior of pipe thoroughly before being laid. When drain lines are left open for connection to discharge lines, the open ends shall be temporarily closed and the location marked with wooden stakes. Perforated pipe shall be laid with perforations facing down. Any length that has had its grade or joints disturbed shall be removed and relaid at no additional cost to the Government. Perforated corrugated polyethylene drainage tubing and plastic piping shall be installed in accordance with manufacturer's specifications and as specified herein. Tubing and piping with physical imperfections shall not be installed.
 - 2. Prior to installation of bedding materials or piping, examination of excavation and subgrades are to be observed by the Resident Engineer. Invert elevation of drain pipe shall not be higher than top of lowest floor elevation nor lower than a 45 degree line projected from bottom of any adjacent footing. Lay drain lines and firmly bed in granular material a minimum of 75 mm (3 inches) below invert to top of pipe to true grades and alignment with bells facing upgrade, and to slope uniformly between elevations shown on foundation drainage drawings. Keep trenches dry

until pipe is in place and granular material backfill is completed to 300 mm (1 foot) above top of pipe, unless otherwise noted.

3. Install gaskets, seals, sleeves, and couplings according to manufacturers written instructions and per the applicable standard:
 - a. PE and PVC pipe installation shall be per ASTM D2321 and ASTM F758.
 - b. PE joint construction shall be per ASTM D2737 and AASHTO HB17, Division II, Section 26.4.2.4, "Joint Properties."
4. Lay perforated pipe with perforations down. Lay plain end pipe with closed joints held in place with two No. 9 spring steel wire clips at each joint or by standard clay collars.
5. For foundation subdrainage, install piping pitched down in direction of flow, at a minimum slope of 0.5 percent and with a minimum cover of 900 mm (3 feet), unless otherwise indicated.
6. Install cleanout extensions where shown on the Contract Documents.
7. Prior to backfilling, check drain lines to assure free flow. Remove obstructions and recheck lines until satisfactory.

D. Jointing

1. Perforated and porous types of drain pipes shall be laid with closed joints.

E. Backfilling: Place filter fabric. Then place granular material, hand tamped, to within 900 mm (3 feet) of finished grade in planting areas. Remainder of backfill shall be comparable to existing adjacent soils. Where foundation drain is within 600 mm (2 feet) of finished grade, one-half of fill shall be made with crushed stone.

1. When drain lines are left open for connection to discharge line, the open ends shall be temporarily closed and their location marked with wooden stakes.

END OF SECTION

APPENDIX

GEOTECHNICAL INVESTIGATION



SPEC SET NO.